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THE PROPERTIES OF ASPHALTS.

In Paving and Municipal Engineering for November, 1893, Prof. DeSmedt furnished an article on "Asphalts and Asphalt Pavements," inviting discussion in regard to the required qualities of asphalt to form the best of pavements. As the inventor of the pavement, as laid in this country, it was most appropriate that he should lead in such discussion. Most of his statements are incontrovertible, but some of them are open to question, either from the obscurity of the language used, or the demonstrated facts of the case.

He says, "asphalts are generally composed of three different hydro-carbons: Retine, soluble in alcohol and undesirable as a component of an asphalt; Petrolene, soluble in ether,'the most important and desirable compound in asphalt for paving purposes, since it is the compound which gives the viscous, adhesive quality to asphalt,' and Asphaltine, which gives the hardness to asphalt, and an excess of which is detrimental in an asphalt for paving purposes."

Technically the language used conveys in places an idea that these substances are specific hydro-carbons, while in other places they are referred to as compounds. The last is correct. Each of these so-called components are compounds of several specific hydro-carbons. The names were first applied under misapprehension that the groups were specific in composition, and so were named with words having a terminable syllable corresponding to the supposition. With the present knowledge of them it would be better to not use these misleading names, but others more appropriate. Prof. DeSmedt gives what purports to be the centesimal proportions of carbon, hydrogen and sulphur, in retine, petrolene and as-

phaltine respectively, without naming the asphalt analyzed to obtain the result. As it is improbable that any two asphalts will agree in the proportions which may be obtained, the statement is misleading. It will be observed that there is no percentage of nitrogen nor of oxygen, which are supposed to be universally present in asphalts.

He says, "the asphalt must not contain over twenty per cent. of asphaltine; not more than three per cent. must be soluble in alcohol, and it must not yield less than seventy-seven per cent. of petrolene, on the presence of which depends the viscous and adhesive qualities of the matrix, * * * preference should be given to the purer article, everything else being equal." We suppose the word "adhesive" is used in the above quotation to include cohesion also; and, possibly, cohesion was the quality intended to be expressed. Certainly the element of an asphalt soluble in alcohol is highly adhesive, and possibly confers this property by its presence more than does the element insoluble in alcohol, but soluble in ether.

We read "in its natural state, and after having been refined, at 400° F. it must still be compressible at 60° F.," etc., etc. What is meant here? Refined asphalt being in an artificial state as a result of refining, we conclude that the writer takes the untenable position that asphalt, whether crude or refined, must meet the conditions which he prescribes. He says it must be compressible at 60° F., but is "compression" meant by him? We suppose not, but rather *impressibility*, then as he gives no conditions as to force applied and time during which applied, the requirement as he states it is met by all asphalts, wherever found, for all asphalts will bend and flow under pressure at even much lower temperatures than 60° F.

He says "asphalt must not contain free sulphur which combines with part of the hydrogen and sulphuretted hydrogen escapes;" also that Bermudez asphalt does not contain it. The writer is unable to declare any certain personal knowledge as to the true status of this sulphur question. His laboratory work has demonstrated that Bermudez asphalt will give off much sulphuretted hydrogen, at temperatures below 250° C. It may be well to cite a reference to this matter of sulphur, taken from the writer's note book: "Mr. O. Hesse (Arch. Pharm.) says experiments show that sulphates and

sulphides are present in asphalt only in very small quantity, whereas organic sulphur exists to the amount of 10.85 per cent., and adds that sulphur is not found free in asphalt."

The statement of analyses given of Bermudez and Trinidad asphalts contains results difficult to verify, and it is misleading from want of fullness and accuracy of form. One may ask if it relates to crude asphalt, refined asphalt or asphalt cement. Pavements are made with cements, not with either the crude or refined asphalt, directly taken, and if there are defective conditions in a refined asphalt, they may be fully remedied in the preparation of cements for paving use.

Is the specific gravity given in the table for pure bitumen or for the mixture of it with insoluble sand, etc.? Is the percentage of residuum, that required for the refined asphalt or for its content of bitumen?

Concerning the proportion of the asphalt soluble in alcohol, the writer obtains very different results from those stated. He readily dissolves of the refined asphalts, in alcohol, about fifty per cent. of Bermudez and rather more of the Trinidad.

Concerning the data of the physical properties of the respective asphalts, to prevent misapprehension, it should be stated that the softer any asphalt is the less residuum oil it requires to make a cement of the proper consistency. When the cement is made its properties of softness, pliability, etc., are matters for consideration and comparison, regardless of what these things may have been in the asphalt from which the cement is manufactured. The claim that the Bermudez asphalt is best because of its lesser percentage of mineral matter, is not well founded. On the one hand, it may affect the relative cost of contained bitumen to the buyer, which has no bearing on the quality of the pavement to be constructed, and on the other hand, it is probable that the mineral ingredients confer excellences for use superior to anything obtainable by the artificial admixture of sand and dust rendered necessary by their absence from an asphalt in its natural state.

D. Torrey.

DOLPHUS TORREY. Biographical sketch in April Number, 1893, page 195.

STREET CLEANING IN FOREIGN CITIES.

PARIS—No. 2.

CLEAN streets; this is what one sees in all the cities and towns of Europe. Fifteen months of travel, with the street making and street cleaning idea in mind, justifies this statement.

Glasgow, Belfast, Liverpool, London, Paris, the smaller towns and cities of France, and those of Holland and Germany, all present a variety of conditions and solutions which can not but be beneficial to American cities and towns, all of which, as far as I know, have failed at solutions of this very difficult problem of street cleaning.

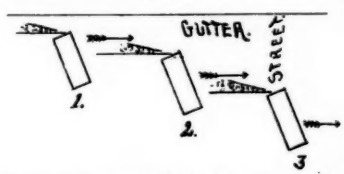
The smaller towns and cities of Holland have cleaner streets than any I saw in Europe. Glasgow is probably the cleanest of the large cities unless it be Berlin. I saw Berlin at a trying time, during days of successive snow storms and generally uncomfortable weather. Yet the authorities were equal to the emergency, and the streets were clean. The English cities, Liverpool, London and others are not models of cleanliness, nor are the small towns of the United Kingdom to be compared with either those of France, Holland or Germany. One finds the small towns and villages of Brittany satisfactory. In looking over the entire field it is fair to say that the small towns and cities are cleaner, in all ways, than the larger ones. The very impressive idea in traveling on the continent is that the streets are all clean and the difference is only one of degree.

In the different locations there are differences in the method and system of doing the work of street cleaning. The general conditions are so various that we of America can there find examples to meet any difficulty which may confront us. We can not say, in excusing ourselves for the condition of our streets in New York, Boston, Chicago or elsewhere, that our conditions are so peculiar that we can not be expected to show streets as clean and satisfactory as those of foreign cities. We can not say that the old world has had many years in which to work up to this state; that they have the wealth which we have not, or the resources which we, as a young country, can not draw upon. None of these statements is true. Clean streets in the foreign cities is the work of recent years. It

is the work brought about within the history of many of our modern American cities. The clean street idea in Europe is relatively a new one. The work is done by a people burdened with taxation, high cost of living and poverty of resource, of which we have no adequate idea. The clean streets are both paved and unpaved. They are clean in towns where abundant use of water is made and in towns where there is no water for that purpose. But they are always clean; immaculately clean; a cleanliness that many of us have never looked upon. We find no condition in our own country in this work which can not be met by those of the cities and towns of the old world. This statement is important from the fact that we are always disposed to excuse our own failures in this work. It is well to meet this at the outset.

It is in Paris that one sees street cleaning on the largest scale and under the most varying conditions. As this is a comparatively new work in that city we may study it with a view of seeing wherein it is applicable to some of our largest cities, bearing in mind that it is not possible to make an absolute transmission of system which will be suited to our requirements. We must take what comes from different conditions and adapt that which appears most rational.

The street sweepings of Paris are, for the most part, washed into the sewers. The sewers of that city are so arranged and planned that this is possible. The plan given here shows three sweepers;



the arrows indicating the direction of their movement along the street. They are light, one-horse affairs. When they move along the street in the way shown by the diagram, each sweeper cleans the space which it covers by the length of its revolving brush cylinder, and it discharges the dirt at the end, because of the inclination of the cylinder. The next sweeper behind it takes the dirt and carries it to the end of its cylinder. Thus the dirt from machine No. 3 is carried by machine No. 2 to machine No. 1, and in this way all is conveyed or brushed from the street proper into the gutter. After this the water is turned into the gutters and the dirt is washed into the sewer. If it does not move freely a workman gives

it a little start with a willow brush, and soon the gutters are running clear water.

In the heavily traveled boulevards this sweeping is largely done at night, though on most of the streets it is done during the day. On a street in which I lived for several months the cleaning operation began about half-past seven or eight in the morning. The first operation was the removal of the garbage and house offal from the galvanized iron buckets and barrels which were placed in front of each apartment house at that hour. There was a certain amount of this material scattered by the rag and garbage pickers before the wagons came to gather it up. A certain other amount of it was dropped on the street by those who were hoisting it into the wagons, while some of this was gathered up and placed in the wagons, no great effort was made in this way. The sweepers followed the wagons immediately, and the natural dirt of the street, together with the droppings from the garbage and ashes, were swept into the gutter; the water was then turned on and the street made free from all impurities. All this was the work of a very few minutes. The wagon hardly stopped while the garbage was being thrown into it. The three sweepers moved up one side of the street and down the other at a fast walk and the work was done. The principle of operation is the same in all streets of whatever width. In some instances they are so narrow that only one sweeper can pass through. Nevertheless, they are regularly swept, the water turned on, and the gutters cleansed.

During times of rain the sweepers could always be seen at work. Rain being frequent in Paris, it served a splendid purpose in helping keep the streets very clean. The sweepers pass over the wet streets and thus their work amounts measurably to scrubbing. The surfaces are rendered as pure and clean as it is possible to make any street covering. Mud there is none. All the dirt being cleaned away the necessary element of mud is lacking. In default of a proper amount of rain, the middle of the street is sprinkled with hose. I speak of it as hose, though in fact it is iron pipe on little wheels, which is dragged around over the streets with greater ease than it would be possible to do with hose. It is less expensive, certainly as to first cost, and manifestly so as regards repairs and re-

newals. I shall give careful drawings of these pipe carriages at another time.

Street sprinkling is necessarily very light where the streets are clean. A small quantity of water serves the purpose. Sloppiness or mud from street sprinkling is something that one never sees in Paris.

LOUIS H. GIBSON. Biographical sketch in January number, 1893, page 13.

Thus we may see that the primary operation in street cleaning is one of sweeping, washing and scrubbing, and finally the use of water to carry the aggregate impurities to the sewers. This is one operation in city cleaning, and is necessarily surrounded by considerable detail, which must follow in subsequent descriptions.

Louis H. Gibson.

GENERAL PLANS IN TOWN BUILDING.

SUCH a title might be more appropriate for an article in some journal of finance, for the only plan in town building seems to be one for securing the largest returns with as little consideration of the physical development of the property possible. How many towns has the reader ever seen which have impressed him with the wisdom of some far-seeing authority in adopting a plan that will best serve the convenience of trade and comfort of its inhabitants? Doubtless a very small slip of paper will accommodate the list. Here, again, is presented a case of "the original responsibility of the engineer," as touched upon in a previous article under that head.

When the owner of any tract of land thinks there is an opportunity to make money by platting a town site or addition he calls in the surveyor's service simply as a means to an end, with little thought of being guided by his advice and experience in anything further than to aid him in marking out the greatest number of salable lots with as little sacrifice of ground as possible. Very often, however, if the engineer is awake to the importance of the matter he can influence operations in many vital points.

In the development of any town site the first question to be set-

tled is, what will be the future demands of business, and along what lines will the various branches of trade best arrange itself or seek to centralize? This question will be determined by what will be the natural tendencies and advantages demanded by railroads, main country thoroughfares or location of material to be operated upon. Having determined these points, let commodious thoroughfares be projected that will not only serve the convenience of the more important centers, but will easily accommodate the tributary interests of the locality.

A proper beginning can not be over-estimated, for "what is worth doing is worth doing well." Men should not engage in a project unless they can undertake it with a broad view for its future possibilities and a confidence for their realization.

There is no more common or greater obstacle in the growth of a town than obstructions to thoroughfares held by selfish individuals that could have been guarded against if action had been taken at the proper time. These obstructions are frequently the cause of diverting the entire trade from one street to another, greatly to the loss of those on the blockaded line, and to the public convenience as well.

In locating thoroughfares the topography of the ground must be taken into consideration and in business districts as much harmony encouraged between the demands of business and natural features as can be done without sacrifice to business interests. This, however, is of most importance and the engineer's skill can be employed to overcome the obstacles of nature. In residence districts it is different, for there is nothing more pleasing and home-like than improvements made conforming with the beauties that nature has prepared for man by her gentle hills, winding ridges and undulations of surface. But, as before stated, the main arteries of trade and outlets to business must be extended on a broad scope with a foresight reaching a generation ahead of any conflicting or restricting improvements that may be made by private parties.

Corporation authorities can not be too far-seeing in providing for the future of their town. A town or city should, when extending her limits, at the same time arrange to secure proper and uniform outlets or connections with her main thoroughfares. Greater attention should be also given by the citizens in choosing corpora-

tion authorities that are broad and liberal enough in their views to deal with matters of this kind in a way that will encourage enterprise, not only for public improvements, but for private as well. There is no surer means of securing private enterprise and improvement than by the public example set in improving her thoroughfares.

So far reference only has been made to streets; but alleys, drains, sewers and other public conveniences should be considered as well. The point most desired to be urged is that those most closely related to the interest of town development should thoroughly inform themselves upon the best course to pursue in adopting a proper plan that can be adhered to and extended to meet any requirement that good fortune may bring to the locality. The narrow or liberal spirit of a community, their careful and uniform methods of procedure, or their carelessness and haphazard methods can be usually predicted by her streets, and they often determine the destiny of a town. What might not St. Louis be to-day if she had been started upon plans as wise as her new generation are endeavoring to provide for her? But alas, her stingy so-called streets along her magnificent river front will ever be a source of annoyance and reproach to her, for they leave a bad impression upon those who do not see the beauties displayed further back from the river in her magnificent residence districts.

On the other hand, note how much favorable comment we hear passed upon our national capital, because of her thoroughfares. In going more into the details of some points that should be observed in planning for a town or its extension, the drainage and sewerage should be early considered, for as a town grows there is probably no one thing that requires more reconstruction and consequent loss than the temporary make-shifts and inadequate provisions in this line.

The locating of sewers in alleys is a question worthy of consideration by engineers, and if ample provisions are made for alleys there seem to be many points in favor of locating them there instead of in the streets, as is usually done.

In this connection let our engineer hold out for wide alleys such

as will accommodate the hauling and trucking of adjacent property, especially in business districts or those liable to become such.

Another matter of importance that seldom receives any attention until too late is that of park spaces and reservations for public buildings, such as schools, churches, libraries, etc. Life in any town, and more especially in cities, would be more enjoyable, and health would be improved, by ample provisions for places of public comfort and fresh air.

What is more pitiful than to behold the sallow faces and bleached countenances of those tender human plants struggling for life and existence in crowded tenement houses and flats or apartment buildings? It is a public responsibility that opportunities be made available for all classes and conditions to partake of and enjoy God's blessing of fresh air and sunshine. A healthy public sentiment should be encouraged that will demand this. A law to such effect would be desirable, but as it would neither benefit the lawyers nor the saloon-keepers we can scarcely hope to see such a one enacted. *Frank Knight.*

RELATION OF WHEEL TIRES TO THE PAVING PROBLEM.

I HAVE just read Mr. Emile E. Berthoud's "Heavy Traffic Pavements" in PAVING AND MUNICIPAL ENGINEERING. Being more interested in the paving question than perhaps any other, I desire to get as near down to the root of the matter as possible.

Mr. Berthoud speaks of what he "believes to be the best paving under existing circumstances." What I desire to know is what he means by "existing circumstances." Do they refer to the use of heavy-traffic wheels? Does he recognize the fact that "heavy traffic" streets may be made into light traffic streets by some change in wheel widths used?

I can hardly think he is writing from the standpoint of the many city engineers who say, "Damn the vehicles, so the pavement lasts." Yet I am not able to believe that he fails to see that heavy traffic is due to inadequate wheel width and not to heavy loads.

He evidently means heavy loads by "heavy traffic," and not a large volume of traffic, for volume has little or nothing to do with durability of foundation. He must mean that heavy loads are

"heavier" per ton than light loads, and, of course, "heavier" means more destructive to the pavement and the same depth of foundation per ton.

He says of "Belgian pitch cemented joint" that "its durability is impaired quickly under heavy traffic, the subway not being strong enough." What he says is proper and right if he is absolutely certain that street traffic, however "heavy," would not cost more per ton in, say fifty years, on his new pavement than on asphalt, brick or say granite-topped macadam in the same time, and if he ignores the fact that the best remedy for the destructiveness of "heavy traffic" is to make it light by the use of light traffic wheels.

In the first place, can Mr. Berthoud measure heaviness of traffic in units of effect on pavement alone? Must we not have a unit of combined effect on horse, vehicle and pavement? The combined effect on vehicle and pavement is certainly what causes the pull. Pull, in so far as the pavement can affect it, is proportioned to combined wear of vehicle and pavement. Taking pull per ton on asphalt, say at fifteen pounds inclusive of (a) pounds of hub friction, common to both pavements, and pull per ton on granite block at thirty-three pounds at a walk and sixty-six pounds at a trot, inclusive of (a) pounds hub friction, and considering the probable fact that the cost of pull is greater per pound on granite than on asphalt, I fail to see how granite block would be as cheap—give as cheap traffic—as asphalt or brick, even if it were a free gift or accompanied by a lively bonus to users.

It would be hard to say just how much of the 15 pounds takes effect in wear of the asphalt on the one hand and the horse and vehicle on the other, but since there is three or four or five times—according to speed—as much pull on the granite to take effect somewhere and the vehicle must get a larger proportionate share, it is not hard to see that granite is much the more expensive to horses and vehicles. I simply can not believe it to be possible that, even under the present destructive use of horses, vehicles and all pavements, any possible saving in total pavement or inconvenience—relaying or repairing—cost of granite block over asphalt, or brick, or granite macadam, could compensate for the loss due to greater cost of using horses and vehicles on the granite block.

Take the usual course of paving a city gradually, and say that

alternate streets are to be paved with asphalt, for example, and granite respectively. Mr. Berthoud would find that the asphalt would get the heavy traffic—heavy both as to load and volume. Of course, if the asphalt gets twice the traffic and lasts half as long for the same expenditure, it is just as cheap as a pavement, and the extra saving in use (cost) of horses and vehicles on asphalt, for which saving both pavements are laid, is a very large clear gain. I can't think that the necessary inconvenience of laying the asphalt once, or even twice, would entail any very serious expense. But let us consider the comparative cost of asphalt and granite pavement for the same traffic and for the life of the asphalt. Granite costs, say, $3.90 and asphalt $2.80. In Memphis granite has averaged about $4.35; asphalt in Chattanooga and St. Louis about $2.75. Take the life of asphalt as ten years. Two cents a year will guarantee maintenance for five years. Starting with a difference of $1.10 per yard, and computing compound interest at 5 per cent., we have a difference at the beginning of second, third, fourth, fifth and sixth years of, at the worst, $1.13½, $1.16, $1.20, $1.24 and $1.28. Seven cents per year for the next five would reduce the difference to $1.25 at beginning of the eleventh year. The difference in favor of our best brick in Memphis, and I venture to say there is none better anywhere than our best, costing $2.42, would be even greater.

This excess "pavement" cost of granite block would alone relay brick and almost relay asphalt. As a matter of fact our brick at $2.42 would outlast our granite at $4.45 under identically the same use. I mean as a decent pavement, since the blocks themselves would probably last longer than the bricks, but at what a terrible cost to horses and vehicles.

But shall we lay pavements to save cost of traffic, the cost of pavement constituting only a part of the total cost of traffic, and yet compare pavements without regard to the saving brought about?

In the second place, if traffic is "too heavy" for brick or asphalt by reason of unnecessary intensity of pressure, why not use light traffic wheels to haul heavy loads as well as light loads?

The Warren-Scharf people have assured and re-assured me that they could and would reduce asphalt guaranty maintenance from 45 cents for ten years as now, to 20 cents or 25 cents, "provided such tire width regulations as (I) you advocate were adopted and

enforced." Now adoption and enforcement depend upon education. This brings me to my original question as to why Mr. Berthoud neglects to educate up to avoidance of alleged necessity for granite while he is educating up to better granite. Doubtless his explanation will be satisfactory, but I find the absence of it very far from being so. Hoping that he will dissolve this difficulty at his earliest convenience, I am, *J. M. Heiskell.*

PAVING BRICK DISCUSSED BY MANUFACTURERS.

A SHORT paper on the subject of vitrified paving brick, written by Mr. W. H. Duffett, of Beatrice, Neb., was read before the National Brick Manufacturers' Association at the annual meeting in Chicago. Extracts from the paper and a condensed report of the discussion which followed it are given below:

"While an apprentice in 1852, I did my first street brick paving in Hampshire, England. The brick were hard-burned building brick, and for sixteen years I walked and drove over that brick pavement, and in all that time it had never been repaired and was in excellent condition.

"In 1868 I came to the States and engaged in contracting for water-works, sewerage and street improvements. In 1888 I was awarded a contract to pave a portion of the streets of Beatrice, Neb. The contract price was $154,000, and to take eight million brick, to be equal in quality to the Galesburgh paving brick. I bought a portion of the brick from the Beatrice Sewer-Pipe Works. In 1889 I purchased this plant, and put in a Penfield outfit, with a capacity of fifty thousand per day. As much of our clay is fractious, also fire-clay and kaolin, we mix fifty per cent. of buff shale clay. The advantage of this is a strong, fractious or fire clay that will stand a great amount of heat and still retain its proper shape. The shale clay will flux at a very much lower heat, which will fuse very readily and run into the pores of the strong, refractory clay, and so make a strong, dense, non-absorbing brick.

"In my opinion and according to my experience, brick for street paving should not be over-vitrified or over-burned, as it is liable to make them brittle and easily broken from the continual blows from

the calks on heavy horseshoes, or it makes them too glassy and liable to chip and break. I prefer burning off brick for paving purposes at a point of vitrifaction, as they then retain their toughness and durability.

"The mixing of clays, in my experience, is a very important point, and depends very much on the properties in the clay. For instance, the analysis of our clay is: Alumina, 38; silica, 55, and iron, 7. With this we mix fifty per cent. buff shale clay, which we burn off at the point of vitrifaction, making a very dense, strong and durable paving brick; which fact our streets in Beatrice prove after five years' hard wear. The brick pavement on Ella street, at the U. P. and B. & M. freight depots, where we have the heaviest traffic in the city, is in excellent condition, and looks as though it was good for many years to come.

"We find the shale clay in this vicinity subject to great shrinkage in drying and burning when not mixed with other clays, and, therefore, a loss in profit to the manufacturers. Again, in selling brick to a paving contractor, we frequently notice that the first thing he will do when he comes to the yard or receives samples of brick is to take his rule and measure the brick, and should he consider them not up to the size, he will endeavor to cut the price down. Even if the manufacturer be the contractor, small brick are not profitable. Being both manufacturer and contractor, I know whereof I speak. In my opinion, brick for paving or building purposes should not be less than 2¼ by 4 by 8½, and would be better if they were 2½ by 4½ by 9 inches. I hope to see the day when there will be a standard size brick made throughout the country."

MR. KOUNTZ, Harmarville, Pa.—I want to say a word or two that will probably start Mr. Purington on the subject. Yesterday a gentleman spoke of vitrifying brick too much and making them brittle. Now there are very few brick, especially shale, which will uniformly vitrify the whole way through. They will vitrify to within an inch of the center, and then they begin to soften up. The engineers and councilmen of the smaller towns, especially where they have been using paving brick, are very particular about this vitrifaction. The first question they ask is, "Is the brick vitrified all the way through?" I do not think they understand that subject thoroughly. My opinion is that if a brick is vitrified a certain

distance that it will withstand the water; that is, it will keep the water from percolating through to the center of the brick. Then that matter of making a brick brittle—the more you burn a brick the more brittle it becomes, and then there is the additional expense of firing, and it is almost impossible to vitrify a brick through to the center; and, too, you run the risk of getting your kiln too hot.

MR. PURINGTON—I am elastic on this subject and can be drawn out to almost any length desired, and the things suggested by the gentleman are important ones in the manufacture of paving brick. I think that one of the principal mistakes that has been made heretofore by manufacturers of paving brick was the tendency to comply with the requirements of contractors who really care nothing at all about the durability of a brick, or at least very little about it. The compliance with their wishes in making a large block is, I think, the rock on which many split. The paving block made for use in this city four years ago were 4x5x12, but I do not believe there is a factory making that size of brick anywhere in this part of the country, because they have been an absolute failure. It was impossible to vitrify them. And I repeat now, what I have said in previous discussions, that I do not like that term vitrifaction. It is a misleading term. Annealing, we have agreed, is a very much better term. This vitrifaction means converting to glass, if it means anything, and we know the nearer a brick is to glass the more brittle it is. Toughness is one of the desirable qualities in a paving brick. In Ohio they make a block 3x4x9. At Galesburgh we have settled on what we think the best size for a paving brick, and it is not over 2¼ thick. We think a smaller brick has better wearing qualities.

MR. CRAFTS—How long will it take to wear a paving brick down?

MR. PURINGTON—That is problematical. They have not been used long enough to answer that question. I should say anywhere from twenty to thirty years.

CAPT. CRAFTS—I should say twenty or fifty thousand years.

MR. PURINGTON—Another reason we have for making a smaller size paving brick is, if there are brick in the kiln that we have failed to anneal they can be used for building brick. We make our brick 8⅝ x4½ x2⅝. That brick when burned and thoroughly annealed is scant 8 inches in length, 2¼ in thickness and scant 4 inches

wide, making the proper size for a building brick. It is only a little over three years ago since we put in a certain kiln at Galesburgh. I do not want to advertise the man's kiln, but I do say that the kiln he now builds is as different from the kiln we built, is as far improved as the down-draft kiln over the up-draft, and so the development of kilns is going on. Every down-draft kiln man I know of, and I keep tab on the most of them, has during the last three or four years improved the quality and processes of his kiln, and if he is in the business to sell kilns, he has got to do it. Most of these kiln men are very quick to adopt valuable suggestions made by the men who use their kiln. When we strike a good thing, we are very apt to tell the kiln man and he takes it and covers it with patents and we get the benefit indirectly. We may have to pay for it, but the tendency is for a gradual improvement all along the line. I think I am stating something that will not be contradicted, when I say that during the last eight years, the coming together in annual convention, the comparing of notes by the members of this Association representing different classes of men from so many different localities, has done more for the machinery men and for the kiln men than it has for us. We have got our share, and are going to get a large share in the future, if we have not in the past, but they are getting more than we are.

MR. KOUNTZ—The point I wanted to bring out, was how far annealing should go.

MR. PURINGTON—I believe a paving brick should never be put on the market unless the annealing process goes through it.

MR. KOUNTZ—But, the great trouble is this. With the majority of brick which I say are not annealed clear through, the engineers will pick them up and break them open and they are glassy, and the engineer will hold up that brick and say it is a good example of a vitrified brick. And they break another one open and it shows a dull appearance, and they say it is no good.

MR. PURINGTON—My experience teaches me that if a brick is broken open and shows that glassy appearance, it is an indication that the brick has been cooled off too suddenly. A hot brick broken open is always of a dull appearance when first broken open, unless

it has been cracked before, and then it shows that glassy appearance.

MR. KOUNTZ—A great many people argue to the contrary, but I think a brick should be dull, and I know that the brick we make are dull when broken open.

MR. PURINGTON—One of our greatest mistakes is we open our kilns too quick. I believe if we would leave our kilns closed up for two weeks, even in warm weather, until almost cold, that we would get a great deal better results. There is no question about it; we open our kilns too soon. We ought to have more kiln room.

MR. KOUNTZ—That is the point I wanted to bring out.

CAPT. CRAFTS—I am not capable of discussing this question. I merely want to state some facts. The city of North Haven had occasion to pave some streets with brick. They got some vitrified brick from Syracuse, N. Y., and some from Barrington, R. I., and they took some 4,000 North Haven brick that would absorb eight ounces of water, and these brick were put down about five years ago, and we can see no difference in the brick. Now, if common brick will do that well, what would be the life of a thoroughly vitrified or annealed brick? I think 20,000 years would not cover it.

MR. MORRISON—I am interested very much in this discussion. I am not a paving brick manufacturer, but may be some day. I want to know whether a paving brick should present a smooth, glassy appearance inside after being broken open. Is that necessary, or should it be slightly porous or dull in color? And I would like to know about the amount of moisture a paving brick ought to absorb, or whether there is a proper gauge? Say, take one that weighs six pounds; how much moisture ought it to absorb, or should it absorb any?

MR. PURINGTON—In regard to the first query as to the glassy appearance of a brick broken open: It is caused by the brick being cracked in the drying or burning, and when the cold air strikes the surface that is exposed it causes that glassy appearance when the brick are broken open. A brick that requires force to break open is always dull in appearance, which goes to prove my statement that the glassy appearance is caused by the cracks before being cooled off. In regard to the amount of moisture, I think that two and a half ounces of water is as much as a good paving brick

will absorb, and one that will absorb more than that is not a good paving brick. The brick that Captain Crafts referred to were common brick burned in an up-draft kiln. My opinion is that you can not burn an annealed brick successfully in an up-draft kiln. You can not count on getting a large per cent. of good paving brick. The admission of cold air in an up-draft kiln is a preventive of the annealing process.

EDWARD ORTON, JR., Columbus, Ohio—I want to take issue with Mr. Purington's statement in one thing. I do not think the glassy fracture of an annealed brick is due to any other than one thing, and that occurs after the brick has attained the vitrifying or annealing temperature. I have found, in my experience in paving brick manufacture, that where two brick are attached to each other in the process of burning, or are in any way prevented from shrinking or contracting during the cooling process, that that kind of a brick, when broken open, is very apt to show a glassy fracture through some part, and if you take the same brick and chip a small piece off the end, it will almost invariably be dull in appearance. I think there is only one time at which this glassy fracture is attained, and that cracks in drying or making do not produce it. In regard to the proper size of a paving material: Mr. Purington stands committed to a brick 8x2¼x4 inches. My experience is attained as a superintendent of a paving brick plant, and I am not now financially interested in any plant, nor am I employed by any firm, and my opinion is unbiased, and is based on the experience I have had. I have made both sizes of paving brick. I have made the block size used in Ohio, 3x4x9, and I have made the common brick size, and I have an intimate acquaintance with those making them. I have made the larger size, 3x4x9, and vitrified them to the core. I think it is possible to make that size of paving brick successfully and vitrify them to the core to the satisfaction of any responsible engineer. I have done so myself with several different kinds of clay, and I think there is a great advantage in having a little larger size than a common brick. I stand committed in favor of a block 3x4x9, and my reasons are as follows: In the rattling test a large and small brick made of the same material will lose proportionately the same number of ounces in the same number of revolutions. The percentage lost on the large brick is the

smallest. In the crushing test the large brick requires about the same number of tons pressure to crush it as the smaller brick. The smaller brick has the advantage in the crushing test, but, in my judgment, the crushing test does not amount to much. The rattling test is the best, and the large brick have the advantage in the rattling test. Now, when you come to lay these brick in the street, it does not take so long to lay them, and they give a little better service; there are fewer joints to the square yard; there are fewer points where failure is liable to begin, and it gives the horses' feet a better chance to catch. Also, it may be the brick will wobble a little when first put in the street, and when the edges are sharp and square they are almost sure to rub against each other and chip off, and this will not show so much on a large brick with rounded edges as on a small one with square edges. A gentleman here said in his experience the wear on the brick in the first year is always the most, and that is my experience. If I were going to run a paving brick factory for myself, or for any one else, I would recommend the making of two kinds of material. First, a 3x4x9 block, and, second, a common brick. I would recommend the making of the blocks only in such proportions as to vitrify all of them, and in those parts of the kiln where I could not easily vitrify the blocks I would put common brick, and sell them for what I could get for them. My experience is that if you take twenty-five courses of shale paving material of ordinary fire qualities, and you can vitrify twenty of these courses satisfactorily without overburning the top in a down-draft kiln, that you ought to rest content with that. And below those twenty courses I would put brick of the ordinary size.

Capt. Crafts—Would it not be just as well to make the common size, and then if any failed to vitrify, they would be just the proper size for building brick?

Mr. Orton—I have stated my opinion in regard to the proper size of a paving brick. I think 3 x 4 x 9 inches is the proper size for a paving brick. If I were in business for myself, I would undoubtedly try to make our product in two different sizes. Where a manufacturer makes two sizes, he is not under such a temptation to sell a softer material for different purposes. If a man has but one size, and he has orders pressing, he opens up a kiln, it looks pretty well, he takes off the top, and it is a question how far down

he can go. He will keep at it and the first thing you know, he has some brick in the car that ought not to be there. It is impossible for any one man in charge of a plant to maintain proper uniformity in such a case. I have never been able to get out a shipment where the same quality is maintained throughout the car. No man likes to throw away $10 brick for $5, and the temptation to sell a $5 brick for $10 is always strong.

MR. BOEHNCKE—I want to say a word in regard to the durability of paving brick. In 1885, I suggested to the city authorities of a city here in the United States that they pave their streets with brick. They asked me where brick were used. I recommended them to write to the authorities of a city in Germany where I had laid a brick pavement in 1875, and they wrote to that city, and they got back the answer that those brick had been laid for ten years, and they could not see any wear and tear on them, whatever. The city authorities said, "well, if there is no wear and tear on them, we do not want that kind of pavement, for it would not give us any work for our men."

MR. EUDALY—I want to take issue with Mr. Orton and the people in his section of Ohio in regard to a paving block. In regard to the glassy appearance of a brick when broken open, I agree with what my friend Purington has said. In regard to the question of paving block, and the small size of paving brick, this question has been before the convention every year, and every time it has been discussed there have been some men who advocate the ordinary size brick and some the block. Those who advocate the ordinary size argue that from their standpoint it suits the plans and convenience and their pocket-books to make the ordinary size better than it does to make the blocks. Those who advocate the block say that it covers a larger surface of the street, but I believe that the principal manufacturers who have given the subject a great deal of attention have come to the conclusion that the best paving brick is the size as adopted last year by this Association as the standard size for a paving brick, which is not a block, but is 8¼ x4x2¼, notwithstanding my friend's very able opinion to the contrary. These Hayden blocks that they manufacture in Ohio, when they are imbedded in the sand, if they are not set firmly, will in a short time wobble. I think you all know what I mean. When the wagon wheel strikes one block

it rubs on the other, and that on the next one and so on. I was in a city the other day where a street had just been paved with brick. Blocks and bricks had both been used in the same square. I found that I could walk over those large blocks and press them with my foot, and press one edge of the block down and the other end would come up, and I tried a number of them and found them to be the same. I suppose the paving block men would answer me by saying that the blocks were not properly laid. A contractor in laying two sizes of brick in the street will be strongly tempted not to lay the block properly, while they can not do so with the small brick in imbedding it in sand. I am in favor of a round-cornered brick. I think it undoubtedly the best for a paving brick. With the sharp-cornered brick there is a tendency for the corners to chip off when first laid in the street, say for the first month or two, and so shows wear and tear that a round-cornered brick does not show. In my opinion a paving-brick manufacturer should not make two sizes of paving brick. Still, I believe there would be some reason for doing so if he were manufacturing large blocks. I do not believe you can burn a kiln full of large blocks to as good advantage as you can a kiln full of ordinary brick. It is hard to do. You are more likely to overburn some of the blocks in order to get some of the others burned perfectly, but you are much more liable to come to the conclusion that your brick are thoroughly burned when they are not. There are many clays that will vitrify well in a small brick that will not make blocks. That may strike some of you as peculiar, but such is the fact. Some clays that will make an exceedingly good paving brick, if made in a large block are very likely to remain soft in the center of the brick; whereas, if the brick are small, there is no part of the brick that can not be vitrified. Then I believe, as Mr. Purington has already stated, that if you have some brick that are not suited for paving brick, you can sell them for building purposes. There is more money in the ordinary sized paving brick to the manufacturer, but to the contractor and the engineer, who wish to pose as having an unusual amount of wisdom, I believe the block is preferable. An engineer will advocate a block without giving any good reason for it.

MR. TAYLOR—I rise for information. I want to ask Capt. Crafts if he has ever noticed, in regard to those brick that he says absorb

eight ounces of water, in such weather as we are having here to-day, whether the snow has a tendency to leave those brick any sooner than those that are vitrified.

CAPT. CRAFTS—I do not know. That question has never come up.

MR. TAYLOR—The reason I asked the question was that I think it helps paving-brick manufacturers very largely to explain the advantages of their brick. I noticed in New York City that where they use brick in the sidewalks the snow and ice disappear more rapidly than from those constructed of stone and cement.

J. G. SHEA, Danville, Ill.—I want to say in regard to this glassy fracture that it depends upon the clay. I have seen millions of splendid paving brick that had that glassy fracture when broken open, and I have seen brick that did not show that glassy fracture that were excellent. I believe clay that will make good sewer pipe and good stone ware will make good paving brick, but I do not believe it is the proper material. I have come to the conclusion that you can make excellent paving brick out of fire clay if you mix it with other clays. As far as we are concerned about the size of brick, I think I have given my opinion on that subject to this convention every time I have come. [Laughter.] I agree with Mr. Purington. We are making the same size, but I make them at two different factories. I believe in a small size brick. I lay the brick in the street myself, and it does not make much difference which size we lay. Our brick shrink the same as Mr. Purington's. We make them 8¾ and they shrink to 7¾; we make them over 4 inches wide and they shrink to 3½ inches, 2½ inches thick and they shrink to 2¼ inches. A 9-inch brick shrinks to 8½, 2⅞ shrinks to 2⅝ and 4 inches to 3½. When we lay our brick we put the first course like sidewalk brick and put the other course the other way, and in this manner we make a brick pavement that will stand the inspection of the best judges of brick pavements. One of the objections to the large blocks is that horses slip and fall on them. I was in a lawyer's office in a certain city not long ago, and while I sat there I saw four horses slip and fall on the large blocks, and I have never yet seen a horse fall on the smaller brick, and I have put down many miles of them.

B. J. SHEPPARD, Winston, N. C.—The question of size of paving brick has been pretty thoroughly discussed, and I want to say a word

in regard to the round and sharp-cornered brick. I put down a street with the square brick, and the John Porter Co. furnished me some round-cornered brick and another party furnished some round-cornered brick from Zanesville, and we put those brick down and filled in between them with pitch. The objection one of the gentlemen made that the brick would rub does not hold good, for it is impossible for them to rub if they are filled in with pitch. If they are filled in with sand they might, but it is impossible for them to move if they are filled in with pitch. I have talked with a great many firms on the subject of vitrifying brick, and they claim that you can not vitrify brick throughout and set them more than a certain number high. I would suggest, in burning paving brick, if you have brick for building purposes, that you set the building brick in the bottom of the kiln, and if they do not vitrify there is no loss.

W. S. PURINGTON—The question was brought up, how far a brick should be vitrified from its surface. My opinion is that the brick should be vitrified clear through, and as to bringing it just to the point of vitrifaction and then stopping it, is a point that is almost impossible to reach. The proper way is to vitrify them to such a degree that there can be no question as to their hardness. In regard to the matter of making two kinds of brick, and setting one kind in the bottom where the building brick are supposed not to burn hard, I would like to know just how they judge the line. There must be a certain loss. They either burn part of their pavers as building brick, or else they vitrify part of their building brick. Our experience has been that one size of brick is most profitable. I take exceptions to the remarks made by my brother and Mr. Eudaly in regard to the glassy appearance of a brick being caused by being overburned.

MR. EUDALY—I did not say that.

D. V. PURINGTON—I made that statement and Mr. Eudaly agreed with me. [Laughter.]

MR. EUDALY—I have always had so much confidence in what he says that I feel that I must agree with him. I do not think that a brick overburned will show that glassy appearance.

D. V. PURINGTON—I say just that.

W. S. PURINGTON—We have that same glassy appearance in building brick that we do not consider hard enough for pavers.

My opinion is that glassy appearance is caused by the brick not being thoroughly annealed. In regard to the round-cornered brick: We have nearly always made a square-cornered brick. While it might not be as good as the round-cornered, there is always a certain amount of chipping off at the corners, but the small particles that work in the spaces between the brick make up for that.

Jos. STAFFORD, Springfield, Ohio—I have been in the brick business for a great many years. I find there is a question as to whether brick will last in the street. I have come to the conclusion that brick thoroughly burned will outlast granite. I find in the large cities that there is a prejudice against brick. I find, also, granite rings that are working the councils; and I would say to the brick men, Stand together and make good brick, and the victory will be yours. We can only forward our interests by forwarding those of the whole country. I want to tell you, every man here, as regards the different sizes of paving brick, the nearer we come to a uniform brick, the better; the smaller the brick the better pavement. The Illinois Brick and Tile Association are going into the country and paving the roads with brick. [Applause.]

J. G. SHEA—I have noticed within the last two or three years that they have had many conventions throughout the country that they call good road conventions, gotten up by gentlemen who are seeking for information on the hard road question. They don't go to the right shop. They ought to come here. We have clay enough in the state of Illinois to pave every road in it. We have coal enough to burn it, and we have silver enough in our mountains to pay for it. We will take silver if we can not get bonds. [Laughter.]

MR. ITTNER—I would like to hear from Mr. Joseph Fairhall on this subject.

MR. FAIRHALL—This question seems to have been pretty thoroughly discussed, and I do not care to take up the time of the convention. There is one question however, that I think is important, and that is the education of the public on this paving brick question. Nine-tenths of the engineers in this country are not competent judges of brick pavement. They do not understand the methods of paving with brick, although they think they do. With regard to a brick or a block, we have got to conform to the wants of the public. If the public requires blocks, we have to make them,

and as a block manufacturer, I claim it is just as easy to make a block and burn it as it is to burn a brick. I prefer to make brick, but if the public wants blocks, I can make them. This city, which we think is our best field, is using my block 12 x 4 x 5 inches. I think at best it is only a question of good common sense. The town councils are as a rule composed of druggists, lawyers and grocers and others who know nothing about paving brick, and when the question of street paving brick comes up, every one of them can tell a brick man more than he ever expects to know. I can take one of my brick fairly well burned, not vitrified, break it open when it is hot, and it will show a magnificent vitrified appearance all over it, and I will show that to any doctor or druggist and he will say, that is just the kind of a paving brick we are looking for. And it is not vitrified at all, the glassy fracture is caused by the cold air striking it while it is quite hot. What we want is a tough annealed brick, and that is one thing that we as brick manufacturers have got to keep striving for—the best. [Applause.]

Mr. Inglis—I just want to say a word. At the last convention at Louisville, there was no champion in this Association of the word "vitrified," but all were in favor of the term "annealed." Still the word is used. I think the officers of this Association are open to a little friendly criticism on that point, and I would suggest that hereafter in making up the programme that the word "annealed" be used instead of "vitrified."

CURRENT INFORMATION.

PUBLIC WORK FOR THE UNEMPLOYED.

The generally accepted solution of the problem of providing for the unemployed in American cities seems to be that they should be furnished work on public improvements. Instances of this conclusion, noted heretofore in this magazine from time to time, continue to increase.

Objection has been offered at times that the work performed by unskilled labor would not prove of permanent character, but where competent supervision is provided by the city these objections seem groundless. The experience of Altoona, Pa., in employing unskilled labor on public work, has been of the most satisfactory nature. They have been employed since November 27, in macadamizing a number of streets, which, after inspection, have been pronounced thoroughly durable and satisfactory. This work will be provided until April 1 at $1 per day.

An appropriation was made in Attleboro, Mass., for the improvement of highways, but with the provision that none but Attleboro's unemployed should be given work. The town also voted to petition the Legislature for permission to raise $50,000 on water bonds for the purpose of extending the water system to Dodgeville and Hebronville, two villages within the outlying precincts of Attleboro. A great number of the unemployed attended this meeting and voted for the appropriation.

A meeting was recently held in Kearney, Neb., for the purpose of discussing the feasibility of paving the streets and constructing a storm sewer. While the meeting did not result in anything conclusive, it was decided that the only way to assist the Kearney laborer was to give him work, by making public improvements. Mayor Brady pledged himself to give whatever assistance he could in the matter.

The various church aid societies and the Central Relief Committee, the latter consisting of ten members, have given the idle poor of Mansfield, Pa., good care this winter. Men who have, heretofore, depended upon the coal mines and mills for the support of their families, have been furnished with public work at $1.00 per day. One hundred families have received support in this manner during the winter. Chartiers, Pa., has cared for the unemployed in a similar manner.

Several streets will be paved and a sewer one mile in length, will be constructed in Columbus, Ind., to give employment to the idle.

The unemployed of Logansport, Ind., will be given work in making sewer extensions.

A contract has been awarded in Sioux City, Ia., for the construction of a sewer, which will cost $70,000. The contract calls for the employment of Sioux City laborers only.

The board of city affairs of Dayton, O., has authorized that $200,000 in bonds be issued for water-

works and sewer and street improvements. This action was taken for the benefit of the unemployed.

Thousands of idle men in Allegheny, Pa., found employment in the construction of the two big sewers in that city.

Six hundred men applied for work at Franklin Park, recently, in Columbus, Ohio. While it was impossible to give all of them work at the time, the authorities said that all would find employment as soon as the improvements were fairly begun. The men are employed in the order in which they apply.

In Holyoke, Mass., heads of families, who had not had a day's work for many months, were given preference, at the regular wages, on a sewer, by the sewer committee.

An appropriation of $10,000 was made to provide work for the unemployed of Hartford, Conn. This work will be dispensed under the direction of the street commissioners.

Reports say that a noticeable feature of the charity work in Pittsburgh shows a decrease in the number of applicants. The reason assigned for the decrease, by the officials, is that work has been furnished to at least 3,800 families, thus removing a large number from the roll.

Such work as can be done through the winter has been given in Baltimore by the city officials. A resolution was passed January 30, 1894, by both branches of the city councils, providing for the repaving of Poppleton street, which will give work to some of the unemployed.

About seven miles of streets are included in the improvements that are to be made in Chicago for the benefit of the unemployed.

The poor of Des Moines, Ia., are cared for by the Associated Charities whose methods are as follows: Each man who applies for work is ordered to report to the street commissioner, when he is given work upon the street. After working eight hours the men receive a check for $1.36, or 17 cents an hour, which is presented at the headquarters of the Associated Charities. In return for the check, the men receive provisions and clothing. This method of relief will be carried on for some time.

The city council at Joliet, Ill., has taken care of the town poor in the following manner. The poor master issues ration tickets on the town store to all unemployed needing help. These tickets are issued according to the needs of the family and are supposed to provide provisions enough for one month. In return for these tickets the head of the family is, if able, supposed to work three days on work provided by the council. The council appropriated $4,200 to pay for the hiring of teams and foremen for this purpose.

The city of Jamestown, N. Y., has succeeded in borrowing $10,000 for street improvements, and a large number of men and teams are at work on various streets. Moreover, a number of factories have resumed operations with full forces of men, so that Jamestown seems in a comparatively prosperous condition.

The unemployed of Anderson, Ind., number 500, and the majority of them are laborers who are always idle during the winter months. The system of helping the poor in Anderson is to allow each family an order to the amount of $1.50 per week, which, when presented at any store, entitles the holder to a list of rations. A number of the poor receiving help are families from the East, who were attracted by the comparatively flourishing condition of the manufactories of Anderson, and moved there to find employ-

ment, only to find all positions filled by the home laborers. The city will care for them until times get better. Rev. J. A. Glone, pastor of the Trinity Episcopal Church, is at the head of the Associated Charities, and it was the example set by him and the members of his church that the interest displayed later by the citizens in behalf of the poor was aroused.

The Board of Estimate and Apportionment in New York City on February 13 authorized the issue of $500,000 of bonds to pay for the repaving of the streets, which was ordered a few days prior to this, under the special legislative appropriation act. The board also approved some new work to be done by the Park Department out of the $1,000,000 appropriation recently made for the purpose of furnishing work for the unemployed.

The supervisors of the poor, at Minneapolis, met February 7 to receive informal reports from the aldermen regarding the condition of the poor and the progress of the relief work, which was taken up in their respective wards. A principal matter before the board was the proposition to appropriate $3,000 for the benefit of the unemployed, but reports showed that the poor department had sufficient funds to supply its needs during the month. The supervisors considered it premature to vote money at the present time and under the circumstances, and adjourned without action.

The Commercial Club Relief Committee in Indianapolis contintinues to supply food regularly to about 5,000 persons on a system of credit, by which the heads of families are required to perform such work as may be assigned to them at the rate of twelve and a half cents an hour in payment of their accounts. The club gives the labor to the city without charge, and it is utilized on the streets and in the construction of a lake in Garfield Park. The *Review of Reviews* says that "the originality and scientific, as well as practical, character of the Indianapolis plan is the most perfect that has been devised in any of our cities."

A census recently taken of the unemployed in New York City, shows the following: Number of families suffering from lack of employment, 48,681; number of members of these families, 206,701; number of persons out of employment, 69,280. An analysis of the figures compiled by Bradstreet's, has been made by the Manufacturers' Record, showing that 800,000 workmen are idle in 119 cities of the country. In the twenty southern cities it was stated that 42,065 were unemployed. Comparing this section with cities in other parts of the country, Philadelphia alone has 20,000 more idle workmen than the twenty cities, and 40,000 more than the nineteen outside of Baltimore. Pittsburgh has 33,000 more than the twenty cities. New York has 38,000 more and Chicago 23,000 more. The nineteen southern cities outside of Baltimore have a combined population of 1,575,000, which makes the per centage of unemployed 1.4; in Newark, N. J., 6.67 per. cent. of the people are idle; in Philadelphia, 5.9; in Buffalo, N. Y., 6.1; in Pittsburgh, Pa., 3.2, and in Providence, R. I., 7.7.

NATIONAL BRICK MANUFACTURERS' EIGHTH ANNUAL CONVENTION.

The eighth annual convention of the National Brick Manufacturers' Association was held at the Auditorium in Chicago, Ill., January 23–

25. More than three hundred delegates were present when the first day's session of the convention was called to order by the President, Mr. Anthony Ittner, of St. Louis, Mo.

A report was submitted by the Executive Committee, wherein a change in the constitution and by-laws of the association was suggested. These changes were adopted after a discussion in which a number of members participated. The officers elected for the ensuing year are as follows: President, William H. Alsip, Chicago, Ill.; first vice-president, Edwin McGraw, Pittsburgh, Pa.; second vice-president, F. L. Stiles, New Haven, Conn.; third vice-president, A. S. Blaffer, New Orleans, La.; secretary, T. A. Randall, Indianapolis, Ind.; treasurer, John W. Sibley, Coaldale, Ala. After an address by the newly-elected president, William H. Alsip, the following papers were presented: "Brickyard Ethics," Donald McDonald, Louisville, Ky.; "The Year's Record," Frank B. McAvoy, Philadelphia, Pa.; "American Enameled Brick," Josiah Miller, Oaks, Pa.; "Glazed Brick, Their Origin, Value and Uses," George B. Engle, Jr., Chicago, Ill.; "The Brickmaker," J. B. McHose, Boone, Ia.; "Profit and Loss in Brickmaking," Joseph P. Cappeau, Pittsburgh, Pa.; "Drying Brick," J. A. Snell, Barrington, R. I., "Progress of Brickmaking in the South," A. S. Blaffer, New Orleans, La.; "Setting Brick in Kilns," Max. A. Th. Boehncke, Centinela, Cal.; "Brickmaking for Profit and Glory (?)," Joseph Fairhall, Grape Creek, Ill.; "Oil as a Fuel for Burning Brick," W. S. Purington, Galesburgh, Ill.; "Vitrified Paving Brick," W. H. Duffett, Beatrice, Neb.; "Waste of Fuel and Drying and Burning," Capt. S. P. Crafts, North Haven, Conn.; "How Can We Best Secure Trained Help," Edward Orton, Jr., Columbus, O. The discussions which followed the reading of these papers were full of interesting and valuable points. The questions brought forth by them were thoroughly and practically discussed by the different members. On Wednesday evening, January 24, the Chicago members of the association tendered a banquet to the visiting members. Mr. D. V. Purington, presided as master of ceremonies. Three hundred guests were present.

A PENNSYLVANIA BUILDER OF GOOD ROADS.

Mr. A. J. Cassatt, living near Haverford College Station, Pa., and one of the directors of the Pennsylvania Railway, has been road supervisor in Lower Merion township for ten years. He is known as a leader in public improvements and as a skilled roadmaker. It was the prominent part he took in converting Lancaster pike into a fine macadamized road that induced his neighbors and friends to prevail upon him to become a candidate for road supervisor, which he did, with success. Immediately upon taking the office Mr. Cassatt began a systematic plan of constructing fine macadam and Telford roads throughout the township, which resulted in adding millions of dollars to the value of its real estate and drawing a large number of desirable residents. Mr. Cassatt began his plan of improving at the township's centers of population and pushed the work toward the interior of the township, a prosperous farming district. In this way hundreds of miles of valuable roads have been built, and the value of scores of farms has been increased to three and four times their orig-

inal value. Appreciation of his work is now shown by an attempt, on the part of people who have not been favored with good roads along their property, to defeat him for re-election because his plans have not included the highways in which they are particularly interested.

DEFEAT OF PITTSBURGH'S BIG IMPROVEMENT LOAN.

A proposition to submit to a popular vote, in the city of Pittsburgh, the question of authorizing a loan of $6,000,000, to be used in public work, after having been indorsed by both branches of council, was vetoed by the Mayor. It was proposed to use $2,000,000 of the sum for repairing streets in the old city, $2,000,000 for parks, and $2,000,000 for the improvement of the water supply. The expenditure should give Pittsburgh improvements which would make it, physically, one of the model cities of the country. The proposition was strongly opposed, however, by the Chamber of Commerce, and it seems that this opposition was based mainly on the charge made by Mr. Oliver McClintock, a leading business man of Pittsburgh, that there have been impositions in the past in the construction of street pavements in that city. His specific charge was that $3.85 per square yard had been paid for a vulcanite pavement. This, considered by itself, is not a sufficient reason for defeating the proposition. If public work has not been properly and honestly done in Pittsburgh, the officers and citizens of the municipality should see to it that the work is done in the right way, and at fair prices, rather than set themselves squarely against improvement.

STREET PAVING IN MINNEAPOLIS.

Much space is devoted to street paving in the annual report of City Engineer Cappelen, of Minneapolis, Minn., who keeps well in view the fact that a number of the more important streets in the business parts of the city will have to be repaved in 1895. Mr. Cappelen says: "At present Minneapolis has 71⅔ miles of cedar block paving, all on planks; 2 4-9 miles of asphalt; 9 4-9 miles of granite pavement, on sand foundation, and two miles of macadam. The total miles of graded streets are 300, and the total miles of streets in the city are 800. As you are well aware, the price of cedar paving as put down at present is only 85 cents per square yard, but I would recommend in the future cedar paving be put down on a concrete foundation, with joints tarred. The price would be $1.45 to $1.50."

Speaking of granite blocks Mr. Cappelen says: "In several cities granite blocks are laid upon a concrete foundation. The experience in Minneapolis with granite blocks laid upon a sandy soil has proven, however, that it is unnecessary to go to the extra expense of providing a concrete foundation in this city. By specifying that the blocks shall be from three to four inches wide and the wearing surface practically smooth, the cost of the pavement would probably not be increased by more than 30 cents, making a total price per square yard of $1.88."

Brick, blocks, granite, asphaltic paving and the use of concrete are discussed in the report, and a table is given, setting forth the relative merits and cost of these different pavements, for a term of twenty years, on a street which has a

traffic similar to that on Nicollet avenue, which is as follows:

KIND OF PAVING.	Cost per square yard	Cost of removal.	Years worn	Cost per year.
Cedar, with planks, no tar	$ 85	$ 79	6	$ 29
Cedar, concrete and tar	1 45	74	8	30
Granite	1 88	1 88	20	25
*Asphalt	2 75			
Small Minnesota brick	1 80	1 13	10	33
Large Minnesota brick	1 90	1 23	10	33
Galesburg brick	2 15	1 48	10	40½
Ohio brick	2 70	2 03	10	52

*Kept in repair for ten years, after which add eight cents per yard per year.

"From this table it will be seen that as far as cost is concerned, the pavements stand in this order: Granite, cedar, brick (except Ohio), asphalt. As to resistance to traction, the pavements stand in this order, whether new or old: Asphalt, brick, cedar, granite. In the matter of sanitation and beauty, asphalt leads, followed by brick and granite, with cedar last. With reference to least noise, cedar leads, followed in order by asphalt, brick and granite. When pavements are all new, the most pleasant to drive over is cedar, with asphalt second, brick third and granite fourth; but after five years asphalt would lead, with brick second, cedar third and granite last. The easiest pavement on vehicles is asphalt, and next in order comes cedar, brick and granite. The easiest on horses is cedar, with brick, asphalt and granite following. Statistics show that the horse slips more on granite than on asphalt."

Gravel, which has been used with so much success in the Eighth ward, is favored by Mr. Cappelen, but he is opposed to macadam. In his opinion the Kettle river sandstone, a block of which will be laid in the spring as an experiment, will prove soft and expensive.

VITRIFIED BRICK IN ROANOKE, VA.

The reports of the municipal officers of Roanoke, Va., for 1893, have been printed in pamphlet form. Much public work has been done in Roanoke within the last two years. Prior to the last fiscal year there were no paved streets in the city, other than a Belgian block pavement on Jefferson street which was laid by the Norfolk and Western Railroad in front of their property. Vitrified brick pavements on five-inch concrete foundation have been put down by the present board of public works with satisfactory results. The board, in its report, says: "We are well satisfied that vitrified brick laid under the present specifications used in this city will fully meet the requirements of much heavier traffic than the conditions here are likely to demand for many years to come. We believe that when the factors which enter into what constitutes a good pavement are carefully considered, that it will be conceded that vitrified brick possess these factors in a pre-eminent degree. First. Economy in prime cost. Second. Economy in maintenance. Third. Resistance to abrasion and attrition. Fourth. Resistance to absorption of water and consequent freedom from disintegration by freezing. Fifth. Sanitary advantages and facility with which the streets may be cleaned. Sixth. Freedom from the noise of traffic. Seventh. General evenness of surface. In the adoption of vitrified brick for street paving, we are convinced that the city has secured a pavement possessing the qualities enumerated at a minimum of cost."

PHILADELPHIA'S LARGE EXPENDITURE FOR PAVING.

The city of Philadelphia is making rapid progress in street paving. The report of Chief Bullock of the highway bureau shows that at least twice as much paving and repaving

was done during 1893 as in any preceding year, and for 1894 the outlook is promising for the work to be carried far in advance of last year. An appropriation of $1,345,919 was made by the city for pavements, while the passenger railway companies, under the trolley ordinances, expended about $2,000,000 in paving. The report says: "The streets not occupied by passenger railways have been repaved with asphalt, Belgian blocks and vitrified bricks for a distance of 23.56 miles, and small streets have been improved with asphalt, Belgian blocks and granolithic concretes for a distance of 10.6 miles. New streets have been opened and paved as follows: With granite blocks, 5.85 miles; with sheet asphalt, 3.49 miles; with vitrified brick, 7.64 miles; with asphalt blocks, .07 miles; with macadam, 15.34 miles; total, 32.39 miles."

This, with 50.39 miles of cobblestone pavements which were replaced with sheet asphalt, granite blocks and vitrified brick by the different railway companies, makes one-seventh of the entire paved street surface of the city. Much of the repaving of last year, and that which will be done this year, is said to be due to the revolution in the surface railway system. The total length of paved streets in Philadelphia now is 821.19 miles, which with 31 miles of macadamized turnpikes, gives a total length of 852.19 miles of finished roadway.

NEW JERSEY'S ROAD LAW.

The state aid law in road building is being tested in New Jersey, where it was passed in 1891. Aid is available only on the condition that the county and taxing district through which the road to be improved extends bear part of the cost. The state has begun the experiment by appropriating a sum of $75,000 a year, which will be paid to the counties that make appropriations for the construction of stone roads, the county paying two-thirds and the state one-third of the cost. The construction and care of the roads is placed in the hands of township committees, who employ competent supervisors. So far as tried the results have proven so satisfactory that counties are anxious to take advantage of state aid, and the state is being urged to give the law more scope and increase the appropriation by the New Jersey State Road Improvement Association, which has also suggested several changes in the law, all of which are thought to be improvements upon the law as it is now. Some of these suggestions are as follows: That the state pay 40 per cent. of the cost, the township 25 per cent., the county 25 per cent., and that the remaining 10 per cent. be paid by the individuals in a taxing district laid out at a certain distance on each side of the road; that townships be required to prepare and grade the road bed; that the expense of road building in any county should not exceed one-fourth of one per cent. of the taxable property; that townships should be permitted to act independently—the law at present being that state aid is available only for road work undertaken by the county. Objection is made to the New Jersey law for the reason that it applies only to roads built of broken stone, making it practically useless for those parts of the state where stone can be obtained only at great expense, but advocates of the law urge the necessity of this point, its purpose being to encourage improvements of a durable and permanent character throughout the state, experience having proved

that roads constructed of shell, gravel and other substances are not permanently satisfactory.

THE INVESTIGATION BY THE BALTIMORE PAVING COMMISSION.

The Baltimore Paving Commission, appointed to investigate the cost and character of street pavements in American cities, has completed the greater portion of its work and a report will be submitted within a few weeks. The commission was authorized to visit New York, Philadelphia, Boston, Buffalo and Washington. The cold weather prevailing in the North has deterred the members from going to Boston and Buffalo, but they intend to visit these cities before the submission of their report.

Captain G. J. Fiebeger, engineer to the commission, has charge of the surface work in Washington, and his statement of the district paving will be incorporated in the report, although the members of the commission will familiarize themselves with the Washington work by a personal inspection. The officials in New York and Philadelphia, which cities have already been visited, furnished the information secured at those places.

The commission is composed of ex-Mayor James Hodges, chairman; Harry A. Parr, Douglas H. Thomas, Charles Goldsborough and David L. Bartlett. Captain Fiebeger looks after the technical end of the investigations and John W. Daily, clerk to the commission, has stenographic reports of the conversations with the officials of New York and Philadelphia.

In speaking of the inquiry conducted by the commission and its forthcoming report the Baltimore *News* says:

"Washington has the reputation of being the best paved city in the country, and the method of doing the work there will likely be set forth at length in the report. The Washington system is altogether different from the one in vogue here, which is really no system at all. To begin with, the paving in Washington is done cheaper, and the pavements of Baltimore are no better than those in Washington, and it remains for time to tell if they are as good.

"Supposing that the paving done under the supervision of the city commissioner's department is equal to the Washington work, there is no reason why it should cost from 16 to 20 per cent. more. The ashpalt pavements in the two cities are identical. The asphalt blocks manufactured in Baltimore are put down in Washington for $2 a square yard, with a five years' guarantee, and the same company charges for the same blocks laid in this city $2.50 a square yard and keeps the work in repair for only two years.

"There are two grades of sheet asphalt pavements put down in the District, but in Baltimore only one is laid. That corresponds in every respect to the better Washington pavement. It has a concrete base of six inches and a top surface of three inches. The Washington pavement costs $2.25 a square yard, and the identical pavement here costs taxpayers $2.70 a square yard. Then, again, Baltimore gives a large portion of the old material to the contractors, while Washington retains this, but allows the contractor an extra compensation for hauling the old material beyond a certain distance and digging up the streets. Mayor Gilroy, of New York, in a recent communication to the papers, stated that, at a low estimate, it costs 13½ cents to keep a square yard of asphalt pavement in repair for a year. The guarantee on im-

proved pavements in Washington is for five years and here it is two years, so Washington has an advantage in its contracts of 40½ cents on this point alone.

"The Belgian block work is also done cheaper in Washington, but it is not necessary to go out of town for a comparison here. When bids were opened for the Maryland avenue repaving a number of responsible contractors offered to lay a granite pavement for considerably less than the work now costs the city, and the contract was let at $2.54, while the ruling price has been about $3.16 a square yard.

"During the present year over $1,000,000 will be spent in this city for improved pavements, and nearly all this has been appropriated for Belgian block work. Less than $200,000 will be spent for asphalt pavements, and vitrified brick will hardly be used at all. Something new in asphalt paving will be done here this spring. Davis street and Pleasant street will be repaved with asphalt, laid on the cobble-stones as a base. This has been tried in other cities, notably Washington, and it has proved cheaper and more durable.

"The necessity of having a concrete foundation under the Belgian blocks has been repeatedly shown, and the leading cities are now making this addition to the work. It costs more, but its durability is greater.

"Captain Fieberger, who is conducting the investigation for the Baltimore Paving Commission, thus describes the effect of asphalt competition in Washington, where he has charge of the surface work:

"At the opening of the bids for 1893 it was found that the lowest bidder was the Schillinger Paving Company, which proposed to lay the pavement for which we had been paying $2.25 per square yard, for $2.05, and those for which we had been paying $2 for $1.99.

"The samples submitted with the bids were tested by the inspector of asphalt and cements, and were reported unsatisfactory.

"At the request of the bidders I visited the works of the Trinidad Asphalt Company at Jones' Point, New York, from which the Schillinger Company proposed to obtain its supplies. Samples from all the cargoes at these works were again tested by the inspector of asphalt, who reported them land asphalts and inferior to the Trinidad Lake. The best cargo approached so nearly the Trinidad Lake in quality that the commissioners decided to award the contract to the Schillinger Company for one street to be paved with this cargo.

"The company, however, failed to enter into its contract within the specified time and the bid was accordingly rejected. At the opening of bids for work for the current year, it was found that Mr. Thomas H. Thomas, of New York, was the lowest bidder. He was fifteen cents per square yard lower than the Barber Company for asphalt pavement upon a six-inch concrete base, and thirty-five cents per square yard lower upon a four-inch base. His prices were $2.10 for the former and $1.90 for the latter.

"Samples of asphalt submitted by him were examined by the inspector of asphalts and cements, who reported that he did not think it advisable to accept the bid and experiment with a new material.

"At the request of Mr. Thomas further investigations were made, and I visited the refining works at South Amboy and a pavement made with this material in Detroit, Mich., in October, 1892. Further experi-

ments were made in the district laboratory by Prof. Richardson, chemist for the district, and by Profs. Bowen and DeSmedt, chemists for the two competing bidders.

"The laboratory experiment did not seem to give any decided advantage to either of the asphalts, the results being differently interpreted by the various interested parties.

"The pavement laid in Detroit having proved about equal to the Trinidad Lake asphalt laid the same year, it was decided not to reject the bid entirely on account of the material. Mr. Thomas having convinced the commissioners of his ability to carry out any contract entered into by him, and, as the work done by him was to be superintended by Prof. DeSmedt, who has been for several years inspector of asphalts and cements for the district, he was finally awarded a contract for paving about 20,000 square yards. At the present time his work in Washington has been completed, and he is engaged in carrying out his contract. Time alone can demonstrate whether his pavements are equal to those laid with the Trindad Lake asphalt."

THE GOOD ROADS MOVEMENT IN CANADA.

At the regular meeting of the Canadian Institute in Toronto, January 3, 1894, Alan Macdougall, of the Society of Civil Engineers, introduced a resolution regarding road reform, in which he urged that the time had arrived when action should be taken toward bringing about an organization of a good roads association; that the Institute had, on many occasions, inaugurated movements which had proven beneficial to the people of the country, and it was fitting that it should do so now. Mr. Macdougall then moved: "That the Canadian Institute having followed the various steps which have been taken in the past few years to awaken an interest in road reform, and recognizing the inestimable benefit to the community arising from improved and well constructed roads, be it resolved that the Canadian Institute issue an invitation to all persons interested in road reform to meet in convention here on an early date for the purpose of forming a national road improvement association, and that the council be requested to make the necessary arrangements for holding said convention." This motion was unanimously carried. The press was commended by Mr. Macdougall for its systematic agitation for good roads during the last two years.

DECLINE IN THE PRICE OF BELGIAN BLOCK.

Competition in the city of Baltimore has caused a reduction in the cost of Belgian blocks. The average price of granite blocks last year was $67.50 a thousand, and the price this year is $58 a thousand, which is within $3 of the lowest price the city ever paid. When the blocks cost $55 a thousand and other materials were less, granite pavement was laid for $2.52 per square yard in Baltimore.

NEW PUBLICATIONS.

A souvenir of the new city hall at Springfield, Ill., which has been issued under the direction of the common council, is in the form of an illustrated brochure, giving a history of the work which has resulted in the construction of the building, with pictures of the officials and citizens who have had most to do with forwarding the project.

T. M. Chatard and Edgar Rich-

ards have undertaken the publication in Washington, D. C., of a new journal to be known as the *Technical World*, the special purpose of which will be to give abstracts of chemical information from trade and scientific journals. It is not the intention to furnish original articles or to copy those already published, but, to use their own words, their task will be "to glean the scientific field thoroughly, to separate the wheat from the chaff and even to grade the wheat." The idea is new and the specimen number which has been issued indicates that it will be well developed. The subscription price of the publication will be $3 per year.

PERSONAL.

Mr. Alexander Potter has opened another office at 700 and 701 Lewis Block, Pittsburgh, Pa., retaining his office in New York City for consulting purposes only.

Mr. J. L. Frankeburger has been appointed to superintend the construction of the new water system at Boulder, Col.

Mr. Geo. C. Morgan, of Chicago, has been employed to superintend the construction of the water plant at Grinnell, Ia.

Mr. Charles Platt, A. C., of the Vandenbergh Laboratory of Chemical Industry, recently examined sources of supply for water-works at Evansville, Ind., Winchester, Va., Grafton and Elkins, W. Va.

Mr. James Scripps was recently elected president of the Park and Boulevard Commission, and Mr. George C. Wetherbee vice-president at Detroit, Mich.

Mr. J. D. Cotter, of Chattanooga, Tenn., has been elected superintendent of the water-works at Newman, Ga.

Mr. George S. Pierson, of Kalamazoo, Mich., has been engaged to furnish plans for a complete system of sewerage for Hamilton, O.

Mr. Abraham Gottlieb, civil engineer of Chicago, died suddenly in the Rookery building, February 9, of heart failure.

Mr. Clifford Richardson, Washington, D. C., will sever his connection with the engineering department of the District of Columbia, March 1, and will open an office as consulting expert in technical chemistry, with special reference to asphalt, hydraulic cement, water and the general inspection of construction material.

The city officers at Newport, Ky., for 1894 are: Paris C. Brown, mayor; M. J. Costigan, city clerk; T. P. Carothers, city attorney; B. R. Morton, city engineer and superintendent of water-works; J. M. Betz, secretary of water-works.

LETTERS FOR THE PUBLIC.

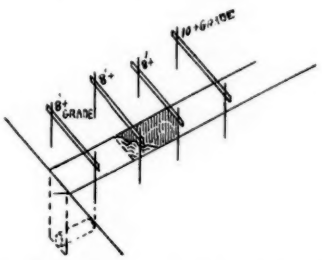
GRADE AND LINE FOR LAYING SEWER PIPE.

To the Editor of Paving and Municipal Engineering:

You ask for new ideas, but probably there is nothing new if we had the brains to discover the old. Instead of giving grade and line for laying sewer pipe at the bottom of trench, I find it easier and more accurate to give grade on 5-ft. stakes driven 25 feet or so apart along trench on either side. Say we make marks on the first pair of

stakes 8 ft.+grade. Now do the same at some point where the grade changes, placing marks 10 ft.+grade. Now nail the top of a 1x4-in. pine strip at each point at grade and drive nails in strips or bars at the center of trench. Set transit over nail and level. With rod on first strip see what rod reads up to eye end of instrument—say 3.85, which, added to height of strip (8 ft.) makes 11.85=height of instrument+grade. Again, 11.85—10 ft. (height of farther strip)=1.85=reading of the rod to be held on farther strip. Place the cross wires on the center of the target and clamp, and you are ready to *slide* in grade on the intermediate stakes 10 ft.+grade, no matter how far the stakes are apart; or, if you set the target 3.85, the marks will be 8 ft.+grade, where cross hairs hit the center of the target. Now run in the centers by driving tacks for the contractor to fasten his line and you have got the grade and line of pipe at any point by plumbing and measuring down. In this way I have used transit (with level) for giving grade on railroad embankment thirty years ago, so I see nothing new about it. All depends on setting the telescope parallel with the grade line.

I send you a poor illustration.



This avoids a good deal of figuring where the distances are unequal. *F. R. Lockling,*

City Engineer and Sewer Com'r.

Hannibal, Mo., Jan. 10.

PUBLIC WORK IN SAGINAW.

To the Editor of Paving and Municipal Engineering:

The total cost of street improvements, under the direction of the board of public works, during the season of 1893 in this city, was $151,132.72; 52,074 square yards of paving were constructed, at a cost of $72,820.92; 2.119 miles of brick sewers and 4.52 miles of pipe sewer were built, at a cost of $65,-010.09; about 5.5 miles of suburban roads were covered with a 6-inch layer of broken stone, cost $9,402.66; $3,356.98 were spent for turnpiking and grading unimproved streets, and $542.07 in the construction of tile drains. For the season of 1894 our common council has under consideration the paving and repaving of eleven streets, at an estimated cost of $166,011. *Udo Hesse.*

MEETINGS OF CIVIL ENGINEERS.

Civil Engineers' Society of St. Paul.—The regular meeting of the Civil Engineers' Society, of St. Paul, was held at the society room directly after a dinner at the Commercial Club, in which 18 members participated. After the approval of the minutes of the previous meeting the president called upon Mr. C. A. Hunt, who explained in a general way the repairs now in progress on the dam at St. Anthony Falls.

Mr. Hilgard then gave his theory of the failure of a portion of the roof of the St. P. & N. P. tunnel at Westminster street. The tunnel has a clear width of 28 feet, and in that part under consideration was quite flatly arched with four concentric rings of brick at the crown instead of five as provided by its designer after brick had been ordered substituted in this section in place of cut stone used in other sec-

tions of the tunnel. In the course of seven years the arch at the under side of the crown had settled about one foot and a cross section of the intrados showed a slightly sinuous line. Careful inspection failed to prove any definitely measurable displacement or settlement of the vertical sidewalls. In settling, the brick rings separated from one to three inches as near as might be on the line of greatest pressure and but slightly elsewhere. For instance, at the crown the greatest open space had formed immediately below the external, and at haunches, above the internal ring. The passage of this line of principal separation through intermediate rings in offsets corresponding to the radial joints was marked by longitudinal cracks.

In Mr. Hilgard's opinion the settling of the arch was due to the gradual grinding out of mortar from both ring and radial joints affected by the vibration of roof and the general jarring caused by the frequent passing of weighty trains puffing through the tunnel on a heavy grade (traffic continuing through the tunnel during its construction).

Furthermore, this section of the arch, although resting on heavier sidewalls than those supporting the stone arch, lacked the lateral support and surcharge of the contemplated filling which had been indefinitely postponed by the rival railroad corporation owning the ground crossed, and which had insisted on the building of the tunnel entirely across its right of way through the Trout Brook hollow. The weight and bulk of this file, if made, would have considerably checked the vibrations. Mr. Hilgard suggested that the lesson taught by this case was that for similar arches under like conditions cut stone should be used instead of brick. Should brick be a necessary resort cut stone blocks should be inserted at proper intervals to form an absolutely necessary bond between the several rings. Further, that arches exposed to vibration and jarring should be built considerably heavier than the load alone would require.

Mr. Münster followed Mr. Hilgard with a few remarks on the measurement of water in connection with the test of a pumping engine of 6,000,000 gallons capacity, and distributed blue print copies of an original diagram for weir measurements, giving quantities in cubic feet per second from gauge readings for all weirs up to ten feet in length.

President Wilson then produced some topographical maps of the Connecticut State survey, which would have been examined with more interest but for the lateness of the hour. *C. L. Annan, Sec.*

Illinois Society of Civil Engineers.—You can state in your much esteemed magazine that the Society of Civil Engineers and Surveyors of Illinois held their ninth annual convention at the University Building at Champaign on the 24th, 25th and 26th of January, and had a fair number in attendance, considering that most of them had taken vacations during the World's Columbian Exposition and the hard times now. Many papers of great value and interest were read, lively discussions following each. I think I express the sentiment of every member and visitor there when I say it was good to have been there. We adjourned to meet at the next annual meeting, January 25, at the city of Monmouth, on the main line of the Burlington Railroad, 186 miles west of Chicago, with

D. W. Mead, of Rockford, Ill., for president. *Thos. S. McClanahan.*

Engineering Association of the South.—The regular monthly meeting was held at headquarters on the 8th inst. at 8 P. M. Vice-President Smith presided. The following applications for membership were received and referred: Charles Page Perrin, manager of the Soquatchie Valley Coal and Coke Co., Pikeville, Tenn.; A. P. Gaines, superintendent of the Cowan division of the Tennessee Coal, Iron and Railroad Co., Cowan, Tenn.; I. O. Walker, superintendent of track, buildings and bridges of the P., T. and A. Railroad, Paris, Tenn.; Alfred Hume, Junior E. A. S., professor of mathematics in the University of Mississippi, transfer to full membership.

The association having been requested to appoint a committee of three to represent it in the convention soon to be held for the purpose or organizing the Tennessee centennial, the president announced the following appointments: Mr. Newell Sanders, manager of the Chattanooga Plow Co., Chattanooga, Tenn.; Dr. W. L. Dudley, Vanderbilt University, Nashville, Tenn.; Major Niles Meriwether, city engineer of Memphis, Tenn. Two alternates, residents of Davidson county, will be named to act in the event of the absence of regular appointees.

No positive promise of a paper for the next meeting having been received, the following question is announced for discussion: "What are the best and cheapest railroad culverts of areas under fifty (50) feet?" Written discussions by members unable to attend are requested.

The paper of the evening was presented by Mr. Tyler Calhoun, Junior E. A. S., superintendent of the Whitwell colliery of the Tennessee Coal, Iron and Railroad Co., Whitwell, Tenn. It described in detail the method of handling coal at these mines by gravity.

The mines are situated on the side of Cumberland Mountain, 1,100 feet above the tracks of the N. C. & St. L. Railway. There are three openings in the face of the mountain. The coal is brought by means of tram cars to the head of a double track incline at the central opening, and there dumped into bins. From the bins the trip cars, carrying five tons each and running in pairs on both ends of the cable, are filled. The incline is nearly a mile long, and is controlled by drums at the top, with powerful band brakes and automatic fan governors. The cable used is the Hewitt patent interlocked steel wire, 1¼ inches in diameter. The coal is dumped over a screen at the bottom of the incline with diamond top bars arranged in a series of planes, with a fall of six inches between each plane. The railroad tracks are built on a grade, and cars are moved past the chute by gravity.

The use of powder in the mines is largely avoided by undermining in the day and allowing the settling of the roof to loosen the coal during the night. The mines are drained by siphons, so arranged as to be primed by one man without stoppage. So completely has the force of gravity been utilized that there is not a steam boiler on the work. Ventilation is effected by furnaces. The output of the mine is about 1,000 tons per day.

Hunter McDonald, Sec.

Association of Engineers of Virginia.—The annual meeting was held January 31 and February 3, 1894. The president, Mr. Chas. S. Churchill, in the chair, with fifteen members present. The direc-

tors reported as follows: Members in good standing at annual meeting of 1893, 87; lost by death or resignation in 1893, 11; new members received in 1893, 10; members on roll annual meeting of 1894, 86; resident members, 27; non-resident members, 59. In addition to the three regular meeting, six monthly meetings were held during the year, all of which were well attended and very interesting.

The completion by the association of a set of building regulations, applicable to a medium sized city of twenty thousand population or over (which are about to be adopted by the city of Roanoke), the work on a road law for the State of Virginia, also several excellent papers and discussions presented by our members at both the regular and monthly meetings, show a very creditable year for the association, and the published proceedings for the year 1893 will be of great value to every member. The president announced the election of officers for the year 1894 to be in order, and appointed Messrs. M. E. Yeatman, R. H. Soule and G. R. Henderson as scrutineers, who reported as follows: For president, Chas. S. Churchill; for vice-president, W. H. Adams; for directors (to serve three years), J. B. Fuller, H. A. Gillis; for treasurer, J. R. Schick; for secretary, Jno. A. Pilcher. Having been approved by the board of directors the following new members were elected: Mr. L. S. Randolph, of Blacksburg, Va., and Mr. S. A. White, of Roanoke, Virginia.

Mr. Churchill presented the report of the committee on regulations governing the erection of buildings. The committee, as per instructions, had presented these regulations to the city council of Roanoke, and later to the council committee on ordinances, who accepted them and who propose to recommend them for adoption as a building law for the city of Roanoke at the next council meeting. Action of the committee was approved and the full set of regulations was referred to the publication committee.

Mr. Coleman presented the report of the committee on state laws for public roads, which, after being taken up by sections and discussed, was adopted with slight amendments.

Mr. Dunlap moved that a committee, consisting of Mr. Clarence Coleman and Mr. J. C. Rawn, be appointed to take the proper steps to bring the proposed law before the state legislature. Motion carried. This proposed road law was forwarded by the committee to the state legislature on February 3d.

A paper was read by Mr. Rene de Saussure on "Graphical Methods." It proved to be very interesting, and after discussion was on motion of Mr. Henderson referred to the committee on publication.

The monthly meetings and subjects were announced as follows: February 28, "Bridging the Hudson River," Charles C. Wentworth; March 21, "Blast Furnace Construction," Rubens Patterson; April 18, "Aluminum Alloys," Samuel Wallis; May 16, "Boiler Construction," G. R. Henderson. Representative Thomas has presented to the state legislature of Virginia the road laws prepared and submitted by the association.

Jno. A. Pilcher, Sec.

MACHINERY AND TRADE.

THE MONARCH BRICK MACHINE.

The monarch brick machine of Wellington, O., has gained rapidly in public favor. The latest catalogue issued by the company states that the past season was the third since the machine was placed on the market. Over forty of them were then in operation, and it is claimed that every one of them has made a splendid record. Before this machine was produced, the company was in business of manufacturing soft-mud brick machinery, and the general complaint that came to them regarding all machines, excepting none, was "that they did not last long enough; that they did not have tempering capacity enough; that they did not have pressing capacity enough; that they broke too often, in some cases through lack of enough material in the parts, and in other cases by reason of imperfect safety devices; that they were too complicated, and that their operation took too much power." The company claims that in the Monarch none of these faults will be found to exist. In connection with their explanation of the many good points of the machine, they give a large number of testimonials from persons who have used them. Copies of the catalogue can be obtained by addressing the Wellington Machine Company, Wellington, O.

ENLARGEMENT OF THE GATES IRON WORKS.

Gates Iron Works, of 50 South Clinton street, Chicago, Ill., manufacturers of the famous gyratory rock and ore breaker universally known as the "Gates Crusher," have recently purchased the entire plant, consisting of all buildings, tools, machinery, stock, patterns, drawings, etc., of the Chicago Iron Works, who have an established eprutation in the United States, Canada, Mexico and in the South American republics for the high grade mining machinery they manufactured. With this valuable addition to their plant, the Gates Iron Works are in a better position than ever before to build any kind of machinery required for the reduction and treatment of ores of whatever nature, which fact, coupled with their half-century of experience in this line of manufactures, enables them to warrant to their customers entire satisfaction, and to furnish them modern machinery of the highest merit both as regards material and workmanship, fully guaranteed to do the work required of it, at prices unequaled in the market for the same class and grade of goods. Any one contemplating the purchase of machinery for mining or milling purposes, will find it of great personal interest, both financially and otherwise, to communicate their wants to Gates Iron Works at the above address, or to any one of their following ,banch offices: 237 Franklin street, Boston, Mass.; 136 Liberty street, New York City, and 73a Queen Victoria street, London, England.

A NEW ASPHALTIC PAVING COMPANY.

A new paving company has been organized in Detroit, Mich., which is known as the Western Bermudez Company. The officers of the company are as follows: President, Eugene Robinson; vice-president, Otto E. C. Guelich; secretary, Thomas J. Tully; treasurer, George Maitland; superintendent, Harry Collins. It has a capital stock of $65,000. It is the intention of the new company to compete in the

asphaltic paving contracts which are contemplated in Detroit for next summer, and to engage in asphaltic paving throughout the state of Michigan and territory west thereof.

NOTES.

The Carson Trench Machine Company of Boston has issued a handsomely illustrated catalogue containing information regarding their machines, together with testimonials as to their efficiency.

Among the companies which have prepared to meet the demand for paving brick in a satisfactory way is the Clinton Paving & Building Brick Company, Clinton, Ind., which has a well equipped plant with material of the requisite qualities. The company is prepared to turn out a good paver at reasonable prices.

One of the catalogues for 1894, issued by the Wellington Machine Company, of Wellington, Ohio, is devoted largely to explanation of the advantages of the new Quaker brick machine for both horse and steam power. The many valuable points in the machine are clearly set forth, and the improvements are fully explained. Interested persons in writing to the Wellington Company should ask especially for the catalogue devoted to these machines.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

The recent inspection of the bituminous rock paving on a number of streets in San Francisco shows satisfactory work.

A bill has been introduced providing that Hornellsville, N. Y., shall not spend more than $10,000 a year for street pavements.

A boulevard eighty feet wide and extending from the city limits of Portland, Oreg., to Linnton, a distance of four and one-half miles, has been surveyed.

The Rockville and Bethesda Turnpike Company has been incorporated at Rockville, Md., for the purpose of macadamizing the old Georgetown and Rockville turnpike. The entire length of the road is twelve miles.

Thirty-eight blocks of streets were paved with vitrified brick in Winona, Minn., last year, from May 15th to October 1st. The brick used are manufactured by the Purington Paving Brick Company of Galesburgh, Ill. The paving proves highly satisfactory in every way.

A bill relative to the future paving of the streets in North Tonawanda, N. Y., has been drafted. The bill provides for the payment of the assessment levied to cover the cost of the improvement in equal annual payments, the first to become due and payable one year from the date of the confirmation of the tax-roll. Provision is also made for the payment of the cost of paving intersections by a general tax. The new bill is favorably regarded, and overcomes several obstacles that has always confronted the village trustees when an improvement had been made.

CONTEMPLATED WORK.

The paving of Pawling avenue, Troy, N. Y., is receiving consideration.

The question of macadamizing Ocean avenue is being agitated in Patchogue, N. Y.

The city council at New Orleans, La., has been petitioned to gravel Frenchmen street.

Brick paving is being contemplated at Monongahela, Pa. Address, T. M. Boggs, city clerk.

Resolutions have been adopted in Philadelphia, Pa., relative to the extension of Girard avenue.

The paving of Main street, Green Bay, Wis., is being contemplated.

The paving of Central avenue, at Kearney, Neb., is being urgently advocated.

Muncie, Ind., contemplates the construction of several miles of asphaltic and brick paving, this summer.

The city of New Castle, Pa., contemplates paving sundry streets with brick. J. H. Miller, city engineer.

A movement has been made in Milwaukee, Wis., to construct an asphaltic pavement on Grand avenue.

The citizens of St. Joseph, Mich., voted favorably for bonding the city for thirty thousand dollars for paving purposes.

The council at Mount Vernon, Ohio, contemplates constructing a pavement in North Main street, at a cost of $13,000.

An ordinance has been introduced to the city council at Peoria, Ill., for an asphaltic or brick pavement on North Jefferson street.

An ordinance has been passed by the councils, of Easton, Pa., providing for the paving of North Hampton street, with vitrified brick.

The aldermen in New York City recently authorized Public Works Commissioner Daly to pave and repave thoroughfares to the extent of $600,000.

The paving of West Main street and East University avenue in Urbana, to connect with Wright street in Champaign, Ill., is still being contemplated.

A resolution has been passed by the board of public affairs, at Springfield, O., declaring it necessary to macadamize South Fountain avenue.

J. Alcide Chausse, Montreal, Can., writes that the question of laying asphaltic pavements on a number of streets in Kingston, Ont., is receiving consideration.

More than $10,000 will be expended by the board of public works, in Bay City, Mich., in reconstructing the pavements in Fourth and Fifth avenues and Van Buren street.

The city of Piqua, O., contemplates paving Main street and asks for information and estimates for the best material to be used and the cheapest and best methods of construction. Address, Chas. J. Olin, city clerk.

O. R. Rauchfuss, Joliet, Ill., writes that four streets will be paved with brick as soon as the council decides whether or not to construct the pavement of single or double course brick.

About two miles of street paving will be constructed in Crown Point, Ind., in the early spring. While it is probable that cedar blocks will be used, other materials will be considered. Address Frank Knight.

A bill has been introduced at Albany, N. Y., which provides for the construction of a grand boulevard, 182 feet wide, and extending from One Hundred and Sixty-fifth street to Mosholu Parkway, in the annexed district.

Charles G. Carlson, city clerk at Moline, Ill., writes that a meeting was called February 12, for the purpose of passing ordinances on the proposed paving of fifteen blocks of streets and laying twenty thousand feet of tile sidewalks.

Property holders on West Wood street, Youngstown, O., have petitioned for the paving of that thoroughfare this summer, but a difference has arisen regarding the kind of pavement. Some favor asphaltic paving, while others favor brick.

CONTRACTS TO BE LET.

Plans have been prepared at Quincy, Ill., for brick and sandstone paving to cost about $75,000. Address, E. R. Chatten, city engineer.

Sealed proposals will be received in Memphis, Tenn., until March 8, for granite blocks to be furnished to the city during the year 1894.

Bids will be received by John Donnelly, city engineer at Kansas City, Mo., until March 5, for paving Fourth, Vine and Walnut streets.

William C. Bennett, Moline, Ill., invites sealed proposals until April 2, 1894, for grading, excavating, draining, curbing and paving Third avenue.

Bids are invited at La Porte, Ind., until March 26, 1894, for paving, with brick, Main and Madison streets and Michigan avenue. Address Hiram Burner.

Sealed proposals are invited by Sumner T. Bisbee, clerk of council of the city of Keokuk, Ia., until March 5, for paving Main street with paving brick.

Sealed proposals will be received at the office of J. M. Harper, Ninth and Plum streets, Cincinnati, Ohio, until March 13, for macadamizing Woodford road, Pleasant Ridge, Ohio.

Bids will be received at the city clerk's office in Rock Island, Ill., until March 5, for improving and paving with brick, Seventeenth, Nineteenth and Twenty-third streets. A. D. Huesing city clerk.

C. H. Goodwin, Terre Haute, Ind., invites bids until March 6, 1894, for paving sundry streets with brick or asphalt.

Bids are invited by the city of Streator, Ill., until March 6, for the improvement of a number of streets. W. J. Zilm, city clerk.

Sealed proposals will be received at Dubuque, Ia., until March 3, 1894, for the following: One thousand lineal feet of curbing; 450 square yards of guttering; 1,250 square yards of macadamizing. T. J. Cooney, city recorder.

Bids will be received by the street committee, at Cape May, N. J., until March 6, for paving Washington street in three sections: From Perry to Jackson, 7,740 square feet; from Jackson to Decatur, 8,400 square feet; from Decatur to Ocean, 9,612 square feet.

CONTRACTS AWARDED.

The contract for supplying nearly a million of brick for paving purposes, for Toledo, Ohio, was awarded to A. O. Jones, Zanesville, Ohio.

Hafer Brothers, of Chambersburg, Pa., secured the contract for piking more than a mile of street in Shippensburg, Pa., at their bid of $7,600.

O. R. Rauchfuss, city engineer at Joliet, Ill., writes that Lemon & Binzin, who have the contract for paving Richards street, will begin work in the spring. The street is 3,300 feet long and 36 feet wide, clear width between the curbs. It will be paved with cedar blocks on a bed of coarse sand four inches deep.

L. E. Farnham, Camden, N. J., writes that the board of freeholders at Mount Holly, N. J., awarded contracts, February 14th, for the building of a number of stone roads, the total cost of which will be $176,777.54. The contracts were awarded as follows: Mount Holly and Masonville road, to B. M. & J. F. Shanley; Riverside and Bridgeboro road, to New Jersey Paving Company; Medford and Marlton road, to B. M. & J. F. Shanley; Cinnaminson road, to P. McManus; Mount Holly and Wood Lane road, to P. McManus; Evesboro road, to the New Jersey Paving Company.

H. A. Collar, Grand Rapids, Mich., writes that during January the following contracts were awarded for paving with Canton repressed brick: Hamilton street, $2,375; Lincoln street, $4,640; Straight street, $1,094; Prospect avenue, $1,800; Diamond street, $4,975; South Lane avenue, $6,288; West Fulton street, $2,673; Shawmut avenue, from Indiana street to Valley avenue, $10,000; Shawmut avenue, from South front to West Division street, $13,175; South Front street, from Shawmut avenue to Allen street, $5,945. During February contracts were awarded as follows: Ethel avenue, $1,184; Gilbert street, $1,643; Briggs Place, $205.

The contract for macadamizing Kings avenue, between Christina and McPherson streets, at San Francisco, Cal., was awarded to the California Improvement Company.

J. M. James, Sioux Falls, S. D., writes that a contract has been awarded to William Handly for about 2,000 square yards of granite paving at $1.61½ per square yard.

SEWERAGE.

A party of capitalists of Scranton, Pa., visited Stroudsburg, recently, with a view of building a sewerage system and renting it to the borough.

B. R. Morton, city engineer at Newport, Ky., writes that bids have been received for about five miles of pipe sewer, 6 to 21-inches in diameter, 82 catch basins, 183 manholes and 30 flush tanks.

The property owners along Wentworth avenue, Chicago, Ill., are pushing to completion the construction of the sewer extending from the Calumet river and Ninety-ninth street in Wentworth avenue, to Halsted street and north to Eighty-eighth street. The length of this sewer will be ten and one-half miles and the diameter ten and one-half feet, larger by one and one-half feet than any other sewer in Chicago. It will drain a territory of about ten square miles.

CONTEMPLATED WORK.

Monongahela, Pa., contemplates laying pipe sewers.

A system of sewerage is contemplated at Nyack, N. Y.

Belleville, Ill., contemplates building a system of sewerage.

A sewer system for New Albany, Ind., is still being discussed.

Canton, O., is considering the construction of four miles of sewers.

Plans have been prepared for sewerage system at Muscatine, Ia. Address D. E. Eaton, city clerk.

Plans have been made for sewage disposal works at Madison, Wis. Address O. S. Norsmann, city clerk.

Sixteen new sewers will be constructed in the Twenty-third and Twenty-fourth wards in New York City.

A new and complete sewerage system will be constructed at Baltimore, Md. Address F. C. Latrobe, Mayor.

Twelve or fifteen hundred feet of brick sewer will be built in Crown Point, Ind., this spring. Frank Knight.

An appropriation of $100,000 will be asked for the extension of sewers in Victoria, B. C. W. J. Cowler, city clerk.

The aldermen at Malden, Mass., have voted to issue $200,000 worth of bonds for the construction of sewers. Leverett D. Holden, city clerk.

J. M. James, deputy county auditor at Sioux Falls, S. D., writes that the city contemplates the construction of a stone outlet sewer that will cost about $2,500.

A special election will be held at St. Johns, Mich., March 19, for the purpose of voting upon the proposition to issue bonds in the sum of $30,000 for the construction of sewers.

Appropriations for the construction of sewers have been made in Richmond, Va., as follows: Harrison street, $20,000 in 4 per cent. bonds; East Marshall street, $10,000; construction of sewers generally, $40,000.

Sewers will be constructed at Cleveland, O., in the following streets: Brown, Bailey, Bayne, College, Colgate, Empress, Edwards, Fillmore, Floyd, Goulding, Harlem, Homer, Inverness, Jefferson, Mayflower, Mayer, Outhwaite, Slater and Solon.

J. Alcide Chausse writes that the city engineer at Hamilton, Ont., has recommended the construction of sewers for the present year as follows: Robinson street, $13,800; Sandford avenue, $11,275; Mountain avenue, $3,150; John street, $13,750; Burlington street, $4,015; Wentworth and King William streets, $2,660.

H. E. Mann, city engineer at Ashtabula, Ohio, has completed the plans for sewering Sewer District, No. 2. The plans embrace 5,413 feet of brick sewer, varying in size from twenty inches by thirty inches to sixty-two inches in diameter; 31,365 feet of pipe sewer from eight inches to twenty inches in size. The estimated cost is $58,394.77. A portion of the work will probably be done this season.

Willis Ball, city engineer at Beatrice, Neb., writes that the city will construct about 6,000 lineal feet of sanitary sewers, which will be eight inches in diameter. Thirteen man-holes and seven flush tanks will be required. Mr. Ball says: "There will be no curves on the sewer lines at all; the lines will be straight, from manhole to manhole, which will not be more than 300 feet apart; the different parts of the pipe line will be perfectly straight and laid to a true grade, for when built this way it is possible in all cases and at all points to see the lights from one manhole to another. When one line enters into another at right angles, the floor line will be through the manhole, which will be about six feet, a grade of $\frac{3}{10}$ of a foot. The manholes and flush tanks will have 8-inch walls, constructed of paving brick. The flush tanks will be constructed so that the water can be turned outside the tank at a point not less than six feet from it.

CONTRACTS TO BE LET.

Bids are invited by S. Lamb, Toledo, O., until March 12, 1894, for constructing a cylindrical brick sewer.

Bids are invited at Memphis, Tenn., until March 8, for furnishing sewer pipe for the city. W. L. Clapp, Mayor.

Bids are invited by the board of public improvements, St. Louis, Mo., until March 6, for constructing sewers in several districts.

Sealed proposals are invited by Charles H. Goodwin, city clerk at Terre Haute, Ind., until March 6, 1894, for the construction of sewers in a number of streets.

Sealed proposals will be received at Cleveland, Ohio, until March 7, for the construction of sewers in sundry streets and avenues. Clerk board of control.

Sealed proposals will be received at Jamestown, N. D., until March 6, 1894, for the construction of a sewer and appurtenances in Fifth avenue. Plans and specications are on file at the office of the city clerk, and also the consulting engineer, C. F. Loweth, 94 E. 4th street, St. Paul, Minn.

CONTRACTS AWARDED.

The contract for completing the sewer system at Marinette, Wis., has been awarded to W. M. Campbell, of Menominee, Wis.

The council committee on sewers, at Minneapolis, Minn., recently awarded contracts as follows: Three hundred thousand brick at $6.67, and 200,000 brick at $6.97 to John A. Berg, of Minneapolis; 9-inch sewer pipe at 14½ cents; 12-inch, 22 cents; 15-inch, 31 cents; 12-inch Ys, 93 cents; 15-inch Ys, $1.29, to John A. Rich, of Red Wing; 3,000 feet 12-inch cement pipe at 21 cents, 450 feet 5-inch at 30 cents, to A. L. Barnum, of Minneapolis; special castings, Menzel foundry, at $1.45 per pound; Keystone Milwaukee cement at 60 cents per barrel, and Louisville cement at $1.03 per barrel, to Homan Lime and Cement Company.

WATER-WORKS.

The estimate cost of the water-works system at Newton, N. H., is $23,200.

The water-works at North Platte, Neb., have been satisfactorily tested, and accepted by the city.

The work of constructing the water-works system at Waseca, Minn., will begin as soon as spring opens.

The new Dean steam pump, recently purchased at Moline, Ill., has been satisfactorily tested. Chas. G. Carlson writes that it is of 5,000,000 gallons capacity. Total cost, set in place, $14,400.

The new water-works system recently completed at Wheeling, W. Va., has been accepted. The pumping machinery has a capacity of sixteen million gallons in twenty-four hours. The system cost $300,000.

Henry Kelling, city clerk at Walla Walla, Wash., writes that the city council was enjoined from taking any steps regarding the disposition of $160,000 of gold water bonds by an action brought by the local water company.

F. E. Farnham, Camden, N. Y., writes that the channel from which that city draws its water supply is threatened with pollution if the contemplated improvement of the Philadelphia harbor is carried out by the government. The sum of $300,000 is available for immediate use if an improvement or change of water-works is necessitated.

A proposition has been submitted to the city council at Edwardsville, Ill., by Jesse W. Starr, asking for a thirty year franchise to build, equip and operate a system of water-works. If the proposition is accepted, the work of construction will begin within two months, and will be completed within nine months after the franchise is granted. The estimated cost of the plan will be about $50,000.

CONTEMPLATED WORK.

Carey, O., is to have water-works.

Hennessey, Kan., contemplates having water-works.

A system of water-works is contemplated at Earlville, Ky.

A system of water-works is contemplated at Williams, Ia.

St. Charles, Minn., contemplates building water-works.

A water-works plant will be established at Snow Hill, Md.

A system of water-works is being considered for Cadiz, O.

The question of water-works is being considered at Poseyville, Ind.

Forestville, N. Y., is considering the question of putting in a system of water-works.

The town council, at Griffin, Ga., contemplates purchasing a water-works plant for $25,250.

Marcellus, Mich., will vote, March 12, on bonding the city for $8,000 for a water-works system.

A meeting was held recently at Port Jervis, N. Y., to consider the matter of village water-works.

Estimates made of the system of water-works contemplated at Downer's Grove, Ill., place the cost at $26,000.

The council at Galva, Ill., is contemplating a system of water-works.

A system of water-works is contemplated at Alexandria, Ind. Address Pink Varble.

The council at Hutchinson, Minn., contemplates the construction of water-works.

Additional water mains will be constructed at Charlottetown, P. E. I., in the spring, costing about $20,000.

An election will be held in April, at Astoria, Ill., to vote for a system of water-works. H. E. McLaren, city clerk.

The city engineer at Kingston, Ont., has recommended the purchase of a new pump with a capacity of 3,500,000 gallons.

J. Alcide Chausse, Montreal, Can., writes that water-works systems are contemplated at Chilliwack, B. C., and Vernon, B. C.

A water-works system is contemplated at Columbia, Ala. Major W. A. Browne would like to have interested parties visit the city.

Willis Ball, city engineer at Beatrice, Neb., writes that about 4,000 lineal feet of water-works pipe extension will be made in the spring.

Water-works will be constructed at Rushville, Ill. A committee has been appointed to issue bonds, make contracts and superintend the erection of the plant.

An additional set of pumps has been recommended by the city engineer at Hamilton, Ont., to be erected at the beach; also, a new reservoir to be built at a high level.

N. W. Harris and Company, of Chicago, purchased $18,000 worth of city bonds of Martinsville, Ind., the proceeds of which will be used for constructing a system of water-works.

CONTRACTS TO BE LET.

Bids are invited by G. V. Gardner, Altoona, Pa., until April 1, 1894, for the proposed water-works.

Bids will soon be invited for constructing the water-works system at Knightstown, Ind. Address E. H. Cole, clerk.

Bids are invited until March 13, 1894, for the construction of a system of water-works in Nelsonville, O. A. E. Price, city clerk.

Proposals are invited until March 15, at Auburn, Neb., for the construction of a system of water-works. C. O. Snow, city clerk.

The city of Buffalo, Wyo., invites bids until March 31, 1894, for the construction of its proposed gravity system of water-works. Address William H. Fenn, city clerk.

Bids are invited until March 19, for constructing a system of water-works for the city of Kenosha, Wis.

Sealed proposals will be received at Elizabethtown, Ky., until April 1, 1894, for putting in water-works. R. L. Wintersmith, Mayor.

Sealed proposals will be received until March 21, 1894, at Greenfield, Ind., for constructing a system of water-works. Plans and specifications may be procured at the office of the city clerk.

CONTRACTS AWARDED.

The contract for furnishing cast iron water pipes for the Boston water-works, was awarded to P. D. Wood & Co., of Philadelphia, for $104,280.25.

The council at Madison, S. D., awarded the contract for putting in a complete system of water-works, to Fairbanks, Morse & Co., of St. Paul, for $28,950.

The $18,000 water-board bonds of Saginaw, Mich., were awarded to the Savings Bank of East Saginaw and the American Commercial and Savings Bank at their bid of 6 per cent. each. Each bank purchased bonds to the amount of $9,000.

The contract for constructing the water-works at Albion, Ill., was awarded to the Challenge Windmill Company, of Batavia, Ill., for $5,153. The contract includes 1832 feet of mains, steel tower and tank, pump-house, engine, pump and boiler.

BRIDGES.

A bridge over Six Mile creek, Ithaca, N. Y., has been proposed.

A new bridge will be built at Latah, Wash., at a cost of $3,000.

A new bridge is contemplated across the Mahoning river at Brier Hill, O.

A modern wagon bridge has been proposed for the East Side, Toledo, O.

A number of new bridges will be built during the summer in Allen county, Ohio.

A new bridge will be built across East river, in Mason street, at Green Bay, Mich.

A permanent and free bridge to foot passengers is being urged across the east channel of the Ohio river at Wheeling, W. Va.

A scheme is on foot for building a wagon bridge across the Mississippi river at St. Louis.

The road commissioners at Willow, Ill., have concluded to build three iron bridges this year.

The citizens of Chagrin Falls, O., have petitioned for a good substantial bridge across the river.

A new bridge will be constructed at Renfrew, Ont., over the Bonnechere river.

A bridge will be built over the Connestoga river, at Main street, Drayton, Ont. Plans at the office of J. O. Adams.

The city engineer's estimate of the cost of a high level bridge over the Don river, at Queen street, Toronto, Can., is $250,000.

A petition has been presented the commissioners at Kenton, O., asking that a bridge be constructed over the Scioto river at Wayne street.

Messrs. Lawson and Warren, Georgetown, Ont., have been appointed to invite bids for the construction of a new bridge at Glen Williams.

A wagon bridge will be constructed across the Missouri river at Jefferson City, Mo., by the Jefferson City Bridge and Transit Company.

J. Alcide Chausse writes that a new bridge is to be built at Ferguson, Ont. Particulars may be obtained from the town clerk of Wallace, Ont.

A delegation from Rokeby Lock, O., visited McConnellsville February 5, to urge the commissioners to build a bridge across the river at Rokeby Lock.

The contract for constructing all of the bridges in Clinton county, Ia., for the year 1894, was awarded to the Clinton Bridge and Iron Co., of Clinton, Ia.

The new bridge over Cedar river, at Renton, Washington., is completed. The bridge cost $1,800, and is pronounced a handsome and substantial structure.

U. E. Frizzelle, clerk at Stillwater, Mont., will receive bids until March 5, for constructing a bridge across the Rosebud river at Absorakee. Contractor to furnish plans.

A new bridge will be erected at Worcester, Mass., across the Blackstone river at the lower end of Southbridge street. The R. F. Hawkins Iron Works Co. has the contract.

The petition of the town board of Melrose, Wis., for two bridges across Black river, has been accepted. One will be constructed near Melrose and one near North Bend.

A special election was held at Red Wing, Minn., February 8, to vote on issuing bonds for $70,000 for building a wagon bridge across the river. The election was favorable to the bridge.

Bids are invited by T. H. Conniff, county auditor at Pierre, S. D., until April 1, 1894, for the construction of a wooden 36-foot one span bridge across Okobogo creek.

The commissioners of Webster and Hamilton counties will meet at Fort Dodge, Ia., March 1, to arrange for advertising for bids for a bridge across the Des Moines river.

STREET LIGHTING.

The city of Griffin, Ga., wants estimates on an electric light plant. Henry C. Zim, mayor.

Bids are invited until April 1, 1894, for putting an electric light plant in at Elizabethtown, Ky. R. L. Wintersmith, Mayor.

The city of Brunswick, Mo., has voted in favor of constructing an electric light plant. Address City Clerk J. Nappenborger.

M. M. Moore, clerk of council, Columbus, Ga., writes that the city council has awarded the contract for 110 street lights, 2,000 candle power each, to the Brush Electric Light and Power Company, at $90 each per year.

PUBLIC PARKS.

The residents along Front avenue, at Brooklyn, N. Y., want that thoroughfare converted into a park road.

One-half of an entire block has been purchased, at the corner of Kansas street and Raymond avenue, Pasadena, Cal., by Colonel Green, which will be converted into a park.

The first step has been taken toward establishing a park and boulevard system at Peoria, Ill. A petition has been filed, asking for a special election to set apart the new district.

The park commissioners and city engineer, at Bloomington, Ill., have been instructed to prepare plans for a lake at Miller park. An addition of ten acres will also be made to the park.

A will made by D. H. Talbot, an extensive land owner in Sioux City, Ia., bequeaths to the city, at his death, a tract of land containing 4,000 acres along the Sioux river and within the city limits, 960 acres of which is to be used for park purposes and the rest disposed of as the city may see fit. It is estimated that the property is worth fully $100 per acre.